

TRANSACTIONS OF THE AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME XLVII

ESSAY ON THE AMERICAN SPECIES OF ARADUS (HEMIPTERA)

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Every entomologist is in a general way familiar with the "flat-bugs" of the Hemipterous genus *Aradus*, which are often met with beneath the dead bark of trees, but no systematic treatment of the numerous New World species has ever been attempted and they have remained for the most part indeterminable by the majority of students. Bergroth, "le grand maître des Aradides," published in 1892 a list of the nineteen boreal American species then known, with four doubtful species of Walker, giving indications of their distribution, and in other papers he has made various important contributions to our knowledge, describing new forms with great clarity and elucidating the synonymy of the older species. Say, Stål, Uhler, Heidemann, Osborn, and others have given some attention to the group, mostly in the way of descriptions of supposedly new forms or notes on ethology, and Van Duzee, in his Catalogue of 1917, lists thirty-nine species in the genus, including three unrecognized species of Walker and Fyles. To Van Duzee we are further indebted for a very recent contribution (1920) in which are made known some new forms from the west. The palaearctic representatives of the genus have been very fully treated by Kiritshenko (1913) in a most excellent

paper devoted primarily to the Russian fauna, which I was unable to obtain until this essay was nearing completion; but perhaps this independence of treatment will not be without sufficient advantages to outweigh whatever lack of coördination may be noted. I am very greatly indebted to Professor A. Petrunkevitch, of Yale University, for providing me with a scholarly translation of certain portions of Kiritshenko's work, which, except for Latin diagnoses, is in the Russian language.

Fabricius, in 1803, established the genus *Aradus*,¹ as follows:

"*Os* rostro inflexo, sub capitis apice inserto. *Labium* breve membranaceum, setaceum. *Antennae* cylindricae, quadriarticulatae.

"*Aradi* corpus medium oblongum, depressum, planum, immarginatum, tardum, *capite* exserto ovato, antice compresso, subemarginato, margineque postico prominente, acuto, *oculis* globosis, prominulis, lateralibus, *antennis* brevibus articulis distinctioribus, ante oculos insertis, *thorace* plano, transverso, acuto, *clytris* coriaceis, apice membranaceis laud inflexis vix longitudine abdominis, *pedibus* brevibus femoribus longiusculis, clavatis."

The palaearctic *betulae* Linnaeus was indirectly indicated as the type species by a special statement of characters, chiefly generic. Later the genus was restricted to its present limits by the elimination of various discordant elements, such as *Aneurus* Curtis (1827), *Mezira* Amyot and Serville (1843), etc., and it has been held to constitute a distinct subfamily by all authors since 1843, until Reuter (1912), in his comprehensive treatment of the Heteropterous families, advocated its elevation to family rank. This most recent view has not met with universal acceptance, but my own inclination has been to accept Reuter's subdivision of the old families Coreidae, Aradidae, and Tingidae, on the ground that conclusions arrived at in a comprehensive and well-reasoned investigation should not be set aside or ignored without correspondingly complete refutation, based on new evidence or better logic. In the case of the Aradidae such new evidence is afforded by recent discoveries in the anatomy of the trophi. Spooner (1920) has shown that in *Neuroctenus* (of the Mezirinae) the greatly enlarged tylus serves as a sheath for

¹ *Aradus*, an ancient city of Syria (*A' radus*).

the long mandibular and maxillary setae, which, coiled in a vertical, double spiral, occupy the space thus provided. The same remarkable structure in *Aradus quadrilincatus*, *A. robustus*, and *A. similis* (Aradinae) was discovered independently by Miss Caroline A. Hosford, during a morphological investigation carried on in this laboratory. The occurrence of such an important and peculiar type of structure in both groups is, in my opinion, convincing evidence that the Aradinae and Mezirinae are homophyletic, properly subordinate branches of a single well-defined family; and thus their other common characteristics cannot be viewed as merely adaptive features, due to convergent evolution in the same environment, as Reuter maintains, but must be held to signify close relationship.

HABITS

The ethology of these insects, while very imperfectly known, has certain interesting aspects which would seem well worthy of closer investigation. Observations which have been made on two or three species indicate that they feed on the juices of fungi, and it is likely that this will prove to be the general rule (with some exceptions, vide *cinnamomeus*, p. 95), but present knowledge is insufficient to show whether or not the various species are restricted to definite species of fungi, or to the fungi affecting particular trees, as is suggested by such facts as the constant occurrence of *similis*, for instance, about *Polyporus betulinus*, the shelf-fungus of birch.

There are some indications of nascent social instincts to be observed in the behavior of many of the species, for very commonly little colonies made up at most seasons of adults and young in various stages of development may be found clustered in small areas, even where a considerable expanse of apparently uniform conditions is afforded by large sheets of bark.

In their flattened form and in the peculiar mode of articulation of their appendages, the Aradids display structural features most admirably suited to their peculiar abode, which bring to mind very forcibly the vexed questions of adaptation. Ages ago, some more or less flattened ancestor, under the influence, perhaps, of a newly-acquired negative phototropism, discovered

a novel and unerowded habitat under the bark on which he had previously lived, protected in some degree from hostile observation by concealing coloration, and in this seemingly ill-favored environment, become most suitable in the lapse of time, the race has prospered, developing numerous species and achieving a world-wide distribution. More intimate adaptation could hardly be imagined than that which these insects now exhibit, and it seems indeed difficult to reconcile with such conditions a theory of evolution which dogmatically bids us eliminate from consideration any formative or modifying influence of the immediate surroundings; on the contrary the impress of the environment is manifest in every feature of the group. There are some, however, who find it easier to believe in chance adaptation of the animal before it has found its fitting place in the scheme of things, and very likely both processes have had a share in producing every case of observed adaptation, since there is nothing essentially antagonistic in the two views. The old memories still live in the race, notwithstanding the changes which have been affected in the course of time, for in the first warmth of spring obscurity loses its charm for a brief season and the insects emerge and appear on the surface of the bark, where the ancestral coloration still serves to make them invisible, and they fly actively in the sunshine, seeking new and distant homes in obedience to the universal instinct of migration.

PTERYGO-POLYMORPHISM

This power of flight is not shared, however, by all individuals, for, as in many other Hemipterous families, certain species are pterygo-polymorphic, presenting more or less commonly brachypterous individuals which lack functional hind wings and exhibit reduction in the hemielytra, with concomitant modification of the prothorax, within which certain muscles of flight are atrophied. In *Aradus* this reduction is variously related to sex and is manifested in two ways: by abbreviation of the hemielytra, or true brachyptery, and by extreme attenuation without loss in length, which may be termed stenoptery. In both cases the hind wings are vestigial or absent. Occasionally we meet with individual cases of partial brachyptery, with hind wings present,

in species which are normally fully winged (such as *aequalis* and *quadrilineatus*), and very often there is considerable individual variation in hemelytral length. We may suppose that the true polymorphic species have become established as such when unusually pronounced modifications of this kind appeared as mutations, that is, in connection with corresponding germinal changes. None of the species are known to produce normally forms having various distinct degrees of brachyptery, such as occur in the Nabidae and Gerridae. From the following table, which shows the known morphological features of pterygo-polymorphism in the American species, we may note that stenoptery is found only in male individuals, while brachyptery is, with one exception, confined to females, suggesting that the phenomenon is connected with hereditary processes of a Mendelian nature, which invite experimentation. At present the ethological significance of this polymorphism seems quite beyond conjecture, although Reuter (1875) and Kirkaldy (1899) have thought to trace here the workings of natural selection.

Table of Pterygo-polymorphic Species

Species	Macrop- terous	Stenop- terous	Brachypterous	
			Membrane vestigial	Membrane absent
<i>infectus</i>	—	—	♀	—
<i>curticollis</i>	♂	—	♀	—
<i>proboscideus</i>	♂ ♀	—	♀	—
<i>orbiculus</i>	—	♂	♀	—
<i>cinnamomeus</i>	♀	♂	♀	♀
<i>niger</i>	♂ ♀	—	—	♂ ♀
<i>heidemannii</i>	♂ ♀	♂	—	♀

SPECIES FORMATION AND VARIATION

The species of *Aradus* are, with very few exceptions, distinctly differentiated, although the group as a whole is remarkably homogeneous. This condition, with its wide distribution over the earth, would seem to mark the genus as of great geological antiquity, among insects, and as one which has reached a state of relative stability, though still far from the stage when signs of approaching extinction begin to appear. It is evidently enjoying the optimum period of its evolutionary career, after the more profitable adjustments have been accomplished and before

extreme specialization has supervened with its ultimately fatal consequences. Examining in detail the criteria which mark the various forms, we find that they are relatively few in number and are such as to indicate that the species have undoubtedly arisen by a "shuffling of characters." I think, however, that this shuffling must have largely ceased, once the viable combinations were hit upon, and that long since, because we have to do here with true species, each with a characteristic habitus resulting from the combined influence of a multiplicity of minute peculiarities in every part of the body, and thus distinguished not alone by the few criteria which we find expressible in words. *Aradus* provides us with exceptionally favorable material for the study of the species as a taxonomic unit, because, with this clear specific development, there is frequently a high degree of individual variation. In addition to a certain instability in color and size, which is usual among the Hemiptera, there is great diversity among individuals in the details of form and even in the proportions of parts, especially noticeable in some of the species of wide range like *proboscideus* and *similis*, but usually these variations may be recognized as individual peculiarities by their frequent asymmetry, by intergradation, or by an entire lack of correlation with other characters, and there are few which are considerable enough to cause doubt in determination or which are of such nature as, in my opinion, to require naming. Furthermore, the permutational type of evolutionary history referred to above would tend to produce forms having the relatively slight differences in degree of specialization which we meet with in this genus—a condition which strikes us at once in the attempt to arrange the species in an approximately natural linear sequence or even in groups.

ARRANGEMENT OF THE SPECIES IN GROUPS

There are, however, various degrees of relationship among the species, which may be indicated by the establishment of groups, but it must be borne in mind that these groups are by no means sharply distinguished, and both the groups and the species of which they are composed exhibit complicated interrelationships which are quite beyond expression in a linear arrangement.

Thus species which are closely similar, for instance in antennal structure, may differ widely in genital characters, and in general we note a low degree of correlation if we examine the various species with respect to any two or more of the important specific criteria. These conditions are a source of satisfaction in one respect at least; they would seem to preclude any attempt to establish "new" genera at the expense of *Aradus*. I am quite aware that the grouping adopted is unsatisfactory in many particulars; its correlation with Kiritschenko's arrangement of the palaearctic species leaves much to be desired; but a fully acceptable system of groups cannot be established without a comprehensive study of materials representing the species of the world, a study which no one is ready to undertake at present. The American species, fully listed further on, may be grouped according to the subjoined scheme.

Aequalis Group.—Antennae slender, the second and third segments equal in length and cylindrical; pronotal and abdominal margins entire; granulation of body fine. This group, like the four immediately following, contains a single species not closely related to others and causing disturbance if placed elsewhere than at the beginning.

Crenatus Group.—Pronotal margins serrate; abdominal margins strongly crenate; granulation very coarse; antennal characters much as in the preceding.

Quadrilineatus Group.—Third antennal segment strongly enlarged; pronotal structure agreeing in general with the preceding; genital characters distinctive.

Ampliatius Group.—Antennae cylindrical, the third segment long, yellow in apical half; pronotum as in the two preceding; female genitalia peculiar.

Montanus Group.—Antennae moderately stout, about equal in thickness to front femora, the second segment proportionately short, leading toward the next group.

Ornatus Group.—Antennae very stout, clavate, generally roughened; form of body broad; corium strongly dilated at base; coloration often variegated. *Ornatus* is isolated by pronotal and genital structure. The four species following it have oblique, serrate

pronotal sides and rather short genital lobes in the female. *Robustus* has a characteristic pronotal shape, very thick antennae, and long, widely distant female genital lobes. *Intectus* leads to *duzei*, etc., with entire pronotal margins. The species to *implanus* have a long first genital segment in the female; then follows a series with the first genital short and with the antennae thinner, leading toward the next group.

Proboscideus Group.—Antennae slender and cylindrical, the second segment much longer than the third; form of body rather elongate; corium strongly dilated at base. There are two types of pronotal structure: the species to *consors* have the dorsal surface relatively flat; in the rest the anterior region is strongly elevated, the transverse impression deep. The extreme development in length and slenderness of antennae is reached in *debilis*, while *cineticornis* and *parvicornis* manifest a tendency to reduction.

Similis Group.—Antennae slenderly clavate, the second segment enlarging usually from near base and variable in length, but always much longer than the third; general form distinctly elongate, the abdomen often narrowed posteriorly in the female; corium strongly dilated at base. *Opertoneus* is intermediate in some respects between this and the preceding group, especially in antennal structure. In the last four species the first genital segment of the female is very short, recalling the condition in *debilis* and allies.

Compressus Group.—Pronotum flattened, the lateral margins entire; second antennal segment clavate; corium moderately dilated at base; form rather broad.

Tuberculifer Group.—This group is more than usually ill-defined, and consists of three species intermediate with respect to the degree of expansion of the corium between the preceding and following sections. The pronotum is rather flat, with entire margins, and the antennae are slenderly clavate, almost linear in *funestus*.

Lugubris Group.—Pronotal margins generally sinuate anteriorly and entire or granulate; form narrow; second antennal segment narrowed toward base or almost linear; head provided with oblique pale lines at base; the postocular tubercles slight or

absent; color generally black. In this group the basal expansion of the corium is reduced, so that in a majority of the American species the lateral margin of the corium is straight.

Cinnamomeus Group.—Antennae short and thick, almost moniliform; pronotal carinae vestigial; color reddish brown. A single isolated species of wide distribution, which has some affinity, perhaps, with the subgenus *Quilnus*, especially in type of pterygo-polymorphism.

Orbiculus Group.—Second antennal segment very slightly clavate and as long as head; extreme sexual dimorphism. A single species with small stenopterous male and large brachypterous female, somewhat related to *Quilnus* in wing characters and pronotal form.

Insolitus Group.—Margins of pronotum strongly angulate; rostrum extending but little beyond base of head. The remarkable species constituting this group has little relationship with others, but forms a connecting link between the subgenera by reason of its very short rostrum.

Subgenus *Quilnus*.—The three American species form a single well-defined group characterized by the short rostrum, not reaching the base of the head; pronotum small, without expanded margins; and a strong tendency to wing reduction. Kiritshenko's statement "*marginibus lateralibus pronoti totis rectis*" will not always apply, since in macropterous forms the sides may be distinctly sinuate (vide fig. 60).

DISTRIBUTION

Species of the genus *Aradus* have been found in all the great faunal divisions of the world, but a vast majority inhabit the northern hemisphere, few occurring in the tropics. That this is a true expression of the facts, and not one founded merely on inadequate collecting, becomes clearly evident if we consider the records of Aradidae given by Champion in the *Biologia Centrali-Americana* (1897 to 1901). The Aradinae and Mezirinae (Brachyrhynchinae) are found in similar situations and collected by the same methods, but of *Aradus*, representing the former, only one species, *falleni*, is recorded, while of the various Mezirine genera seventy-six species are listed. In the material which

has been available during the present study, I have come across four species from the regions south of the United States. Stål² records *gracilicornis* from Cuba, and Lethierry and Severin³ indicate for *angustellus* a wide dispersal over the South American continent. Bergroth (1895) reports *crenatus* from Mexico, and Uhler (1878) mentions a specimen of *quadrilincatus* which he has from Panama. Champion⁴ remarks that there may be some mistake regarding the two records last noted, but the latter, at least, may be accepted. I have examined the specimen, still preserved in the United States National Museum, which is a perfectly typical *quadrilincatus* (male) and bears the written label, "Pan." In the Cornell collection there are examples of *niger* bearing the label "Mex." It is reasonably certain, however, that further collecting on the central plateau of Mexico will result in the addition of a few more species to the fauna of Central America, since the genus is fairly well represented in the states which include the northern extension of this faunal area. In contrast to this paucity of representation in the Neotropical realm, we find about one hundred and thirty-five species occurring in the northern hemisphere, divided with approximate equality between the Nearectic and Palaearctic regions. With the exception of a few to be noticed presently, the Old World forms are specifically distinct from those of the New, but many of them are closely related and there is every evidence of former intercommunication. Of the three Holarctic species, *crenatus*, *lugubris*, and *cinnamomeus*, the first is confined on this continent to the eastern region (and Mexico ?); the third in its typical form occurs east of the Rocky Mountains and south of Canada, but has produced a western race which ranges as far north as British Columbia; while *lugubris* is met with over the entire continent from the Mexican boundary to Labrador and Alaska. The distribution of this species affords some evidence for the theory of preglacial migration by the northwest route, and might perhaps be cited as lending some support to Scharff's⁵ criticism of the commonly accepted views on the rigors of the Pleistocene climate in the

² Enum. Hem.

³ Cat. Gén. Hém.

⁴ Biol. Cent.-Amer., p. 65, footnote.

⁵ 1912, pp. 76, *et seq.*

north. If we deny that such a species could have maintained its existence here through the period of glaciation, we must imagine it repeatedly driven southward and later returning unchanged by its travels, which, being in a north and south direction, would certainly prove far more eventful than the preceding journey from west to east. On the other hand, it could be argued that the uniform character of the immediate environment, under the dead bark of trees in certain pretty definite stages of decay, might well protect the species from any evolutionary influences which its wanderings might otherwise exert; but we must not overlook in this connection that the genus, compact as it is, contains more than a hundred distinct species, almost all of them produced under these apparently uniform conditions, and hence, while we must suppose that these numerous forms have become differentiated through mutation, it is difficult to believe that the retreat and return could have been accomplished even once without setting in motion the forces underlying germinal change, which quite evidently have been particularly active in this genus.

A few other species deserve especial mention in connection with the subject of geographical distribution. *Aradus falleni* is one of the few animals which are truly Neogaëic; it occurs widely over South America, in Central America, and in North America as far northward as Connecticut and Vancouver Island. Notwithstanding the vast extent of this range there is little variation among individuals and never the slightest doubt in determination. By way of contrast in the matter of variation, we find that *proboscideus*, while fairly constant in specific characters, exhibits a considerable diversity in color and in structural details, more in keeping with its wide distribution—California, the Rocky Mountain region, and east across Canada to New England. *Abbas*, although it occurs throughout the Nearctic region, presents no variation worth mentioning, even in the narrow white annulation of the antennae, but in *lugubris* a similar ornamentation may be developed in varying degrees, quite independently of locality. It may be noted in passing that we have here an excellent illustration of the principle that characters phenotypically identical may depend upon quite diverse internal factors. The annulation of the antennae in *abbas* is evidently the expression of some constant element in the hereditary constitution of the species, while in *lugubris* these markings are subject to individual somatic variation, with the possibility that Mendelian processes are also involved.

The subject of faunal zones is reserved for detailed treatment elsewhere, but the number of species occurring in the various sections of our territory may be indicated roughly as follows:

<i>Northeast</i> (Eastern Canada, New England, New York, Pennsylvania)	27
<i>Southeast</i> (North Carolina, Alabama, Florida)	15
<i>Mississippi Basin</i> (excluding Texas)	21
<i>Northwest</i> (Alaska, Western Canada, Washington, Oregon)	22
<i>Southwest</i> (including Colorado, Texas, excluding California)	22
<i>California</i>	23
<i>Central and South America</i>	4

The following table presents the arrangement of species adopted, together with a brief statement of principal data, not repeated, for the most part, on later pages. Parentheses indicate records taken from the literature. This tabulation should be useful in directing the attention of students to deficiencies in our knowledge, and is intended to serve as a convenient form for recording new observations. Absence of remark in the last column means that only the macropterous form is known.

SYSTEMATIC LIST OF SPECIES WITH SUMMARIZED DATA •

List	Page	Distribution	Host Plants	Poly- morphism
Subgenus ARADUS				
Fabr.				
Aequalis Group				
1. <i>A. aequalis</i> Say	29	Eastern (and southern) North America		Incipient
Crenatus Group				
2. <i>A. crenatus</i> Say	30	Eastern North America (Mexico, Bergr.); Palacaretic.	<i>Platanus</i> , (<i>Pyrus</i> , <i>Quercus</i> , <i>Fagus</i> , <i>Betula</i> , <i>Abies</i> , Kirit.); (maple, hickory, <i>Liriodendron</i> , Heid.).	

List	Page	Distribution	Host Plants	Poly- morphism
Quadrilineatus Group				
3. <i>A. quadrilineatus</i> Say	32	Eastern North America and west across Canada; Panama.	<i>Quercus</i>	Incipient
Ampliatus Group				
4. <i>A. ampliatus</i> Uhl.	33	California		
Montanus Group				
5. <i>A. montanus</i> Bergr.	34	Colorado, 10,000 feet; Quebec.		
Ornatus Group				
6. <i>A. ornatus</i> Say	35	Pennsylvania, District of Columbia, Maryland, Ohio, Indiana.		
7. <i>A. coarctatus</i> Heid.	36	California		
8. <i>A. fuscomaculatus</i> Stål	37	Pacific Coast	<i>Picea sitchensis</i> , live oak.	
9. <i>A. pannosus</i> Van D. var. <i>incomptus</i> var. nov.	38	California.		
10. <i>A. bekrensi</i> Bergr.	39	Pacific Coast		Incipient
11. <i>A. robustus</i> Uhl. var. <i>insignis</i> var. nov.	41	North America, east of Rocky Mountains.	<i>Quercus</i>	
12. <i>A. intectus</i> sp. nov.	42	Wyoming, Colorado.		Exhibited
13. <i>A. duzei</i> Bergr.	43	Northeastern North America	<i>Pinus</i>	
14. <i>A. implanus</i> sp. nov.	45	Northeastern North America		
15. <i>A. apicalis</i> Van D.	46	California		

List	Page	Distribution	Host Plants	Poly- morphism
16. <i>A. curticolis</i> Bergr.	47	North Carolina, Georgia.		
17. <i>A. depictus</i> Van D.	47	Pacific Coast	Live oak	
18. <i>A. concinnus</i> Bergr.	49	Southern Cali- fornia	<i>Platanus</i>	
Proboscideus Group				
19. <i>A. proboscideus</i> Walk.	51	Western states, Alaska, Can- ada, Northern states, New England.	Spruce; fungus. <i>Pinus</i>	Rare
20. <i>A. basalis</i> sp. nov.	54	Mountains of Maine and New Hampshire		
21. <i>A. furrus</i> sp. nov.	55	Arizona		
22. <i>A. consors</i> sp. nov.	56	Massachusetts		
23. <i>A. persimilis</i> Van D.	56	Rocky Mountains	Douglas spruce	
24. <i>A. medioximus</i> sp. nov.	58	Pacific Coast		
25. <i>A. vadosus</i> Van D.	58	British Columbia, Montana		
26. <i>A. debilis</i> Uhl.	59	Western states, ? Massachusetts	(About <i>Cryptoporus</i> on <i>Pinus</i> , Hub- bard)	
27. <i>A. cincticornis</i> Bergr.	61	Alabama		
28. <i>A. parvicornis</i> sp. nov.	62	Oregon, New Mexico		
Similis Group				
29. <i>A. opertaneus</i> sp. nov.	63	Minnesota		
30. <i>A. similis</i> Say var. <i>centriguttatus</i> Bergr.	64	United States, east of Rocky Mountains	<i>Betula</i> , <i>Polyporus</i> (elm, maple, Heid.)	

List	Page	Distribution	Host Plants	Poly- morphism
31. <i>A. shermani</i> Heid.	66	Quebec, Ontario, North Carolina		
32. <i>A. acutus</i> Say	67	United States	<i>Quercus</i>	
33. <i>A. inornatus</i> Uhl.	69	North America, east of Miss- issippi River		
34. <i>A. blaisdelli</i> Van D.	70	West of Rocky Mountains		
35. <i>A. hesperius</i> sp. nov.	71	Colorado, Ari- zona		
36. <i>A. approximatus</i> sp. nov.	72	Maine, New Jer- sey, Mississippi	<i>Pinus</i>	

Compressus Group

37. <i>A. compressus</i> Heid.	73	Northwestern North America		
38. <i>A. borealis</i> Heid.	74	Northeastern North America		
39. <i>A. insignitus</i> sp. nov.	75	Massachusetts		
40. <i>A. uniformis</i> Heid.	76	Eastern United States	<i>Pinus</i>	

Tuberculifer Group

41. <i>A. tuberculifer</i> Kby.	77	Across northern North America, southward through Rocky Mts.		
42. <i>A. parshleyi</i> Van D.	78	British Columbia		
43. <i>A. funestus</i> Bergr.	79	With <i>tuberculifer</i>		

Lugubris Group

44. <i>A. lugubris</i> Fall. var. <i>uigricornis</i> Reut.	80	Holarctic	(<i>Juniperus</i> , <i>Picea</i> , <i>Pinus</i> , Kirit.)	
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List	Page	Distribution	Host Plants	Poly- morphism
45. <i>A. arizonicus</i> sp. nov.	83	Arizona		
46. <i>A. angustellus</i> Blanch.	83	Chili (Colombia, Argentina, Pat- agonia, L. & S.)		
47. <i>A. abbas</i> Bergr.	84	Neartic	(<i>Taxodium</i> , <i>Pinus</i> , Heid.)	
48. <i>A. brevatus</i> Bergr.	86	Florida		
49. <i>A. gracilicornis</i> Stål.	87	Southern states, West Indies	<i>Taxodium dis-</i> <i>tichum</i>	
50. <i>A. marginatus</i> Uhl.	88	Utah		
51. <i>A. uniannulatus</i> sp. nov.	90	New York, Dis- trict of Colum- bia, Michigan, Alberta.		
52. <i>A. evermanni</i> Van D.	91	Southwestern states		
53. <i>A. falleni</i> Stål.	92	Neogacie	(<i>Pinus</i> , Van D.)	
54. <i>A. snowi</i> V. D.	94	Arizona, New Mexico		
Cinnamomeus Group				
55. <i>A. cinnamomeus</i> Panz.	95	United States, east of Rocky Mts., Califor- nia; Palearctic	<i>Pinus</i> (<i>Abies</i> , <i>Picea</i> , <i>Betula</i> , <i>Juniperus</i> , Kirit.)	Exhibited
subsp. <i>antennalis</i> subsp. nov.		Western states		Exhibited
Orbiculus Group				
56. <i>A. orbiculus</i> Van D.	97	Western states	Lodgepole pine	Exhibited
Insolitus Group				
57. <i>A. insolitus</i> Van D.	98	Pacific Coast		

Subgenus *QUILNUS*
Stål.

58. <i>A. niger</i> Stål.	100	Eastern states, Colorado. Mex- ico	<i>Pinus palustris</i> , and other species	Exhibited
59. <i>A. nigrinus</i> sp. nov.	101	Arizona		
60. <i>A. heidemanni</i> Bergr.	102	British Columbia and Rocky Mt. region		Exhibited

NEW SYNONYMY

With the invaluable assistance of Mr. K. G. Blair, of the British Museum, and of Mr. G. A. Moore, of Quebec, as detailed farther on, it has been possible to fix the status of the species hitherto unknown to students of the group, with resulting synonymy as noted below. In studying Uhler's collection I have taken occasion to select type specimens from the original series of species described by him, and have been able to avoid the necessity for any change of names, since his species have been well understood by subsequent authors. The uncertain names listed in Van Duzee's Catalogue on page 135 are disposed of as follows:

A. proboscideus Walker = *A. hubbardi* Heidemann = *A. taylora* Van Duzee (1920).

A. fascicornis Walker = *A. similis* Say.

A. luteolus Fyles = *A. proboscideus* Walker.

The group (or subgenus) *Picstosoma* Lap. is not represented in our fauna.

Little space is devoted in subsequent pages to bibliography and established synonymy, since I can perceive no useful purpose in transcribing this matter from Van Duzee's 1917 Catalogue.

MATERIAL

The material on which this study is based consists of more than twenty-seven hundred specimens of the American species of *Aradus*: a very large number considering the rarity of most of the forms and the difficulties in the way of collecting them. I have had for examination also a considerable number of exotic

species. I append a list of the institutions and individuals whose valued assistance has made it possible to assemble this adequate representation of the group. In returning the material to the various owners, I have provided most of the specimens with a dated label, so that it will always be possible for future students to recognize those which were studied in connection with this investigation.

Academy of Natural Sciences of Philadelphia (H. Skinner).

American Museum of Natural History (F. E. Lutz).

Boston Society of Natural History (C. W. Johnson).

Brooklyn Institute of Arts and Sciences (C. Schaeffer).

Cornell University, including the Heidemann Collection (J. C. Bradley).

Illinois State Laboratory of Natural History (C. P. Alexander).

University of Kansas (C. P. Alexander and H. B. Hungerford).

Louisiana Experiment Station (T. H. Jones).

Massachusetts Agricultural College (H. T. Fernald).

University of Michigan (F. M. Gaige).

University of Minnesota (H. H. Knight).

Museum of Comparative Zoology (N. Banks).

National Collection, Ottawa (C. G. Hewitt, A. Gibson, J. McDonnough).

North Carolina Agricultural Experiment Station (R. W. Leiby).

Ohio State University (H. Osborn).

South Dakota State College (H. C. Severin).

United States National Museum (E. H. Gibson).

Barber, H. G.

McAtce, W. L.

Bergroth, E.

Moore, G. A.

Davis, Wm. T.

Olsen, C. E.

Downes, W.

Osborn, H.

Drake, C. J.

Ruhmann, M. H.

Dury, C.

Slosson, Mrs. A. T.

Frost, C. A.

Torre-Bueno, J. R. de la

Gerhard, W. J.

Van Duzee, E. P.

Hussey, R. F.

Wirtner, M.

Marchand, W.

In closing this introduction I would express my thanks to the many who have assisted in one way or another; on all sides I have found a most hearty spirit of coöperation. It is my pleasant duty to mention especially my indebtedness to Dr. E. Bergroth, of Finland, who has sent to me type specimens of his species, in some cases uniques, and who has given me valuable advice; to Mr. E. P. Van Duzee, of California, who bravely entrusted to the post a large number of indispensable types; to Mr. G. C. Champion and Mr. K. G. Blair for assistance in connection with the Walkerian species; to Mr. G. A. Moore for an extremely careful examination and report on the type of *lutcolus* Fyles.

This paper is dedicated to my wife, who has been of great help in many ways, especially in translating works written in the Swedish language.

SYSTEMATIC TREATMENT

In the following pages will be found full descriptions of the American species of *Aradus*, with detailed distributional records, and figures illustrating important structural features so clearly that certain points, such, for instance, as the shape of the antennal segments, structure of the female genital plates, and form of the pronotum have been entirely eliminated from the descriptive paragraphs. The characters of specific importance, which for the most part were first brought forward as such in the writings of Reuter and Bergroth, will be readily appreciated by students having a general knowledge of entomological terminology; but special mention may be given a few which are less commonly met with outside the group under consideration. The head is peculiar in having a greatly enlarged tylus, sometimes called the median lobe or anterior prolongation; the width of the head is always considered to include the eyes; on the vertex, between the eyes, are two depressions, often connected posteriorly, referred to as impressions of vertex; lateral to the anterior ends of these impressions and obliquely anterior to the eyes are the preocular tubercles, which have sometimes been called ante-, inter-, or intraocular; behind the eyes are the postocular tubercles, called by some authors temporal teeth or tubercles. The disc of the pronotum bears six longitudinal ridges, the carinae; of these the median pair are closely approximated, the

intermediate pair are separated by the preceding, and the lateral pair, always much abbreviated, occupy the postero-lateral angles of the pronotum. In the figures these carinae are represented diagrammatically. The connexivum is the marginal region of the abdomen. The distinct abdominal segments number six, to which is added in the male one genital segment, convex below and hollowed for the reception of the genitalia above, and continued in two genital lobes. This is represented in the figures as seen from below, usually the apex only (except fig. 25b), but in cases of unusual modification (*cf.* fig. 47b), with the preceding segments. In the female there are two genital segments in addition to the six abdominal, of which the first genital bears the female genital lobes and the second is very small (figs. 1a, 1g, 2g, gl.). In observing the important specific characters furnished by the female genital structure, the following points, not referred to in the descriptions, should receive special attention (fig. 1): length of V on median line as compared with length of its lateral margin; shape of its apical margin at middle (ap. m.); position of the imaginary line (xy) connecting the apical angles of VI with reference to the genital segments; length of VI as compared with that of V on median line; shape of apical margin of VI at middle (*cf.* figs. 1a, 3a and 47a); shape of the lateral portion of VI; relative lengths of VI, 1g and 2g; shape of the genital lobes. Very often important characters are afforded by the shape of the dorsal genital segment (fig. 12c, d. g. s.) and of the projecting genital lobes. Strongly costate longitudinal veins divide the corium of the hemelytra into three areas (fig. 12d), the exocorium (ex), mesocorium (m), and endocorium (en), which may be strongly chitinated or hyaline, provided with numerous transverse veinlets or without them.

It will be noted that in the descriptions a good deal of emphasis is placed on the proportions of parts, often indicated by figures in parentheses. The student will find it impossible to estimate these proportions with sufficient accuracy and hence must make use of an eyepiece micrometer placed in one of the eyepieces of the binocular microscope. The examination of ventral structures is greatly facilitated by the use of "art-gum" or some such soft substance, into which the head of the pin may

be inserted; the figures are placed on the plates in positions corresponding to those in which the specimens are most conveniently set for examination with the usual lighting arrangements. Finally, I would refer again to the variability in detail which these insects exhibit; in comparing specimens with the figures slight discrepancies will often be noted, but experience will soon obviate any difficulties which may be encountered on this score.

Family ARADIDAE

(Superfamily *Aradoidea* Reuter)

Insects of flattened form, living under the dead bark of trees. Head horizontal; the tylus greatly enlarged to accommodate the coiled trophic setae; antenniferous tubercles usually provided with an acute lateral process; bucculae forming a rostral groove, which is often continued on the sterna; rostrum four-segmented, the first segment very short; ocelli absent; antennae four-segmented, usually longer than the head. Hemelytra composed of corium, clavus, and membrane; clavus narrowed toward apex, seldom extending beyond apex of scutellum; veins of membrane few, irregular, variable within the species, sometimes lacking. Pleural sutures of thorax vestigial. Hind coxae rotatory. Tarsi two-segmented, always without arolia.

Type genus.—*Aradus* Fabricius.

Table of Subfamilies

Head narrowed behind the eyes, eyes projecting strongly; trochanters connate with femora; abdominal spiracles placed near basal margin of each segment (fig. 1a).....	Aradinae
Head wider just behind eyes than immediately in front of them, eyes not projecting; trochanters free; spiracles midway between basal and apical margins of segments.....	Mezirinae

Subfamily ARADINAE

(Family *Aradidae* Reuter)

Insects of small to moderate size, with roughly tuberculate surface; head narrowed behind eyes; antenniferous tubercles prolonged in a prominent spine, which is often toothed externally;

eyes strongly projecting, sometimes almost pedunculate; ocelli absent; first antennal segment short and thick, suddenly constricted at base to form a short oblique stem; bucculae very short, situated anteriorly; rostrum usually extending beyond base of head; rarely (subgenus *Quilnus*) shorter. Legs of moderate length, homonomous; the trochanters small and scarcely separated from the femora; tarsi two-segmented. Hemelytra composed of corium, clavus, and membrane, the last well differentiated and distinctly veined; pterygo-polymorphism frequent. Ventral transverse sutures of abdomen mostly angulate; spiracles distant from lateral margins, near basal.

Type and only genus.—*Aradus* Fabricius.

Genus **ARADUS** Fabricius

1803. *Aradus* Fabricius, Syst. Rhyng. p. 116.

Flattened ovate or elongate-ovate species with surface more or less roughly granulate. Tylus forming an entire, obtuse, subcylindrical or laterally flattened lobe; a small spine or tubercle placed anteriorly and obliquely inward near the eyes, more or less strongly developed, and usually one behind the eyes; vertex with a variously developed, usually U-shaped impression. Pronotum transverse, with six longitudinal carinae, the lateral pair much abbreviated. Scutellum large, roughly triangular or pentagonal, the margins and base usually elevated. Hemelytra usually shorter and narrower than abdomen, sometimes strongly abbreviated or narrowed, the membrane usually with four longitudinal veins and a varying number of irregularly anastomosing cross-veins. Connexivum widely dilated. Male genital segment large, convex and partially divided ventrally, bearing nearly horizontal genital lobes posteriorly; female with two visible genital segments, completely divided in the median line and, with the similarly divided median portion of the sixth ventral segment, forming movable valves; the first bearing postero-lateral genital lobes partly visible from above, the second much smaller, terminal, and generally not visible from above.

Type species.—*Cimex betulae* Linnaeus.

10. Third antennal segment largely yellow; body black; pronotum two-thirds as long as head; abdomen almost circular.

16. **curticollis** Bergroth

Third antennal segment concolorous, or pale toward apex only; body brownish; pronotum longer.....11

11. Scutellum pentagonal, the sides moderately elevated; color generally almost uniform brown; female genital lobes as viewed from above either very short, transverse (fig. 10a), or long and widely separated (fig. 11a).....12
 Scutellum triangular, sides generally strongly elevated; color often variegated.....13

12. Head longer than pronotum; sides of scutellum elevated to apex.

10. **behrensi** Bergroth

Head as long as pronotum; sides of scutellum scarcely elevated beyond middle.....11. **robustus** Uhler

(a) Nearly uniform dark brown.....variety **robustus** typical

(b) Narrow postero-lateral margins of pronotum, apex of scutellum and most of corium yellowish; abdomen reddish brown above.

variety **insignis** var. nov.

13. Width of third antennal segment about equal to one-half distance between eyes; size small, length, 4.6 mm.....7. **coarctatus** Heidemann
 Width of third segment much less; larger, length over 5.4 mm.....14
14. Sides of pronotum serrate or toothed.....15
 Sides of pronotum entire or finely granulate.....16
15. Third antennal segment more than twice longer than broad; second unicolorous or with very slight paleness at apex.

8. **fuscomaculatus** Stål

Third segment less than twice longer than broad.

9. **pannosus** Van Duzee

(a) Second antennal segment with a broad yellow ring at apex.

variety **pannosus** typical

(b) Second segment unicolorous.....variety **incomptus** var. nov.

16. Second antennal segment distinctly shorter than distance between eyes; only brachypterous form known.....12. **intectus** sp. nov.
 Second segment at least as long as distance between eyes; only macropterous forms known.....17
17. Pronotum widest in basal third; rostrum reaching mesosternum; genital lobes short, truncate posteriorly.....15. **apicalis** Van Duzee
 Pronotum widest at or near middle; rostrum shorter; genital lobes long, rounded posteriorly.....18
18. Sides of scutellum slightly raised, at middle lower than transverse basal elevation; pronotum widest behind middle; median carinae nearly parallel.....13. **duzei** Bergroth
 Sides of scutellum strongly raised, higher than basal elevation; pronotum widest at middle; median carinae sinuate... 14. **implanus** sp. nov.

19. Antero-lateral margins of pronotum distinctly serrate, never deeply sinuate; corium (macro.) always strongly dilated at base, never straight laterally.....20
 Margins of pronotum entire, sometimes evenly granulate, very rarely denticulate, often deeply sinuate; corium either dilated at base (the lateral margin sinuate) or not so dilated (the lateral margin straight).
 40
20. Third antennal segment almost three-fourths as long as second; color uniform dull black; length, 8.3 mm.....5. **montanus** Bergroth
 Third segment about one-half as long as second, or less.....21
21. Third antennal segment at middle almost or quite as thick as front femora; antennae bicolorous.....22
 Second segment at middle distinctly more slender than front femora, never with pale ring at middle.....23
22. Second antennal segment black; disc of scutellum dark in apical half.
 17. **depictus** Van Duzee
 Second segment brown, biannulate; disc of scutellum pale reddish.
 18. **concinus** Bergroth
23. Second antennal segment cylindrical, at least from near base to middle, often enlarged a very little near apex.....24
 Second segment distinctly clavate, gradually enlarging from near base to apex; rarely cylindrical in apical third (fig. 35c) or suddenly enlarged in apical third and about twice as thick at apex as at middle (fig. 36c).
 33
24. Second antennal segment longer than head.....26. **debilis** Uhler
 Second segment shorter than head.....25
25. Antennae very small, scarcely longer than head, slender; scutellum broad, sides arcuate, apical half pale (fig. 28d).....28. **parvicornis** sp. nov.
 Antennae much longer than head; scutellum otherwise.....26
26. Third antennal segment pale in apical two-thirds; disc of pronotum strongly elevated before and behind transverse depression; length, less than 6.8 mm.....27. **cincticornis** Bergroth
 Third segment unicolorous or narrowly pale at apex; disc of pronotum flat or as above.....27
27. Disc of pronotum rather flat, the transverse depression slight and ill-defined.....28
 Disc strongly elevated before and behind the very distinct transverse depression.....31
28. Pronotum widest at middle; sides of abdomen rather strongly crenate.
 22. **consors** sp. nov.
 Pronotum widest well behind middle; sides of abdomen entire or notched.
 29
29. Scutellum much longer than head.....21. **furvus** sp. nov.
 Scutellum not longer than head.....30
30. Granulation of head rough; length of second antennal segment about equal to width of head including one eye (rarely slightly longer); antero-lateral margins of pronotum usually straight, oblique, with variably coarse teeth; form elongate ... 19. **proboscideus** Walker

- Granulation of head smooth; length of second segment at least equal to width of head including both eyes; sides of pronotum slightly arcuate, with very fine irregular teeth; form broad.....20. **basalis** sp. nov.
31. Vertex finely and evenly granulate; lateral expansions of pronotum moderate, very narrow anteriorly, scarcely reflexed.
23. **persimilis** Van Duzee
- Vertex with two rows of coarse granules; lateral expansions wide, continued more broadly to anterior angles, somewhat reflexed.....32
32. Length of second antennal segment equal to head width including one eye; marginal teeth of pronotum large and irregular.
24. **medioximus** sp. nov.
- Length of second segment equal to head width including both eyes; marginal teeth small and even.....25. **vadosus** Van Duzee
33. Length of second antennal segment about equal to distance between eyes, rarely slightly greater.....20. **similis** Say
- (a) Third antennal segment yellowish except at base; membrane hyaline, often faintly maculated; apical angles of connexival segments pale.....variety **similis** typical
- (b) Third antennal segment concolorous; membrane dark with pale basal spot, rarely entirely pale; general coloration nearly uniform light to dark brown.
- variety **centriguttatus** Bergroth
- Length of second antennal segment at least equal to head width including one eye.....34
34. Second antennal segment not or scarcely three times as long as third. 35
- Second segment distinctly more than three times as long as third.....37
35. Rostrum extending to middle of prosternum; second antennal segment about twice as long as third; antero-lateral margins of pronotum straight, oblique.....29. **opertaneus** sp. nov
- Rostrum extending to mesosternum; second antennal segment more than twice as long as third; sides of pronotum arcuate.....36
36. Color grayish, with obscure yellowish markings and a distinct pattern of pale granules; sides of pronotum with a few large teeth anteriorly; second antennal segment strongly clavate, its length equal to head width including both eyes.....32. **acutus** Say
- Color black; pronotal margins with numerous fine teeth; second antennal segment moderately clavate, shorter.
31. **shermani** Heidemann
37. Second antennal segment gradually enlarged from near base.....38
- Second segment cylindrical from base to near middle, strongly enlarged in apical third (fig. 36c).....36. **approximatus** sp. nov
38. Second antennal segment nearly cylindrical beyond middle, sometimes very slightly enlarged at apex; third segment more slender than second at middle (fig. 35c); grayish granules of dorsal surface dense.
35. **hesperius** sp. nov.

Second segment evenly enlarged from near base to apex; third thicker than second at middle (cf. fig. 33c); grayish granules sparse if present.

39

39. Dorsal surface of pronotum nearly flat, the transverse depression slight; carinae feeble; sides scarcely reflexed; rostrum not reaching middle of mesosternum; color uniform reddish to grayish brown.

33. **inornatus** Uhler

Dorsal surface uneven, the transverse depression distinct; carinae well developed; antero-lateral margins of pronotum reflexed; rostrum extending nearly or quite to metasternum; coloration more or less distinctly variegated.

34. **blaisdelli** Van Duzee
40. Corium strongly dilated at base—width of hemielytra at this point usually distinctly greater than width of pronotum, even in brachypterous forms; pronotum sometimes widest well before middle.

Corium slightly or not dilated at base, width about equal to that of pronotum; latter very rarely widest much before middle.

41. Third antennal segment pale.
Third segment concolorous.

42. Pronotum widest behind middle; second antennal segment slightly thicker than front femora.

Pronotum widest before middle; second segment distinctly more slender than front femora.

43. Second antennal segment almost cylindrical, about as long as head; hemielytra strongly narrowed or abbreviated; female much larger and broader than male.

Second segment distinctly clavate, shorter than head; polymorphism not known to occur; sexes similar.

44. Pronotum widest well behind middle (fig. 38d).

38. **borealis** Heidemann

Pronotum widest near middle (cf. fig. 37d).

45. Second antennal segment slightly enlarged from near base; size large, length, 8 mm. or more.

Second segment cylindrical toward base, enlarged from near middle (cf. fig. 41c); smaller, length less than 8 mm.

46. Color black, except spots of connexivum; sides of scutellum strongly and sharply elevated.

Color brown, corium marked with yellow; sides of scutellum moderately elevated.

47. Scutellum distinctly pentagonal, broad, sides very strongly and sharply elevated; sides of pronotum parallel in basal half; length about 6 mm. or more.

Scutellum, and generally pronotal margins, otherwise; length less than 6 mm.

48. Third antennal segment about two-thirds as long as second.

Third segment distinctly less than two-thirds, usually not more than one-half as long as second.

49. Antennae pale brown; antero-lateral margins of pronotum straight; male genital segment with ventral orifice (fig. 53b) . . . 53. **falleni** Stål
 Antennae black and white; antero-lateral margins of pronotum moderately sinuate; male segment without orifice. . . 54. **snowi** Van Duzee
50. Second antennal segment at base nearly as broad as an eye, strongly flattened, narrowed only at extreme base (fig. 46c) (South America).
 46. **angustellus** Blanchard
 Second antennal segment otherwise. 51
51. Antennae moderately robust, the second segment strongly narrowed in basal third (cf. fig. 44c) 52
 Antennae slender, the second segment slightly and gradually enlarged from near base, sometimes rather abruptly thickened near apex (cf. figs. 49c, 52c) 53
52. Scutellum at middle narrower than corium at same level, the discal elevation extending beyond this point; female genital lobes convexly arcuate posteriorly (fig. 44e) 44. **lugubris** Fallen
 (a) Apex of third and sometimes of second antennal segment white.
 variety **lugubris** typical
 (b) Antennae wholly black. variety **nigricornis** Reuter
 Scutellum at middle wider than corium, the discal elevation not extending beyond this point; female genital lobes concavely arcuate posteriorly (fig. 45e) 45. **arizonicus** sp. nov.
53. Pronotum widest well behind middle, the postero-lateral margins rounded or nearly parallel (cf. figs. 47d, 49d) 54
 Pronotum widest slightly behind middle, the postero-lateral margins straight and distinctly convergent (cf. fig. 50d) 56
54. Antennae biannulate with white; corium not hyaline 55
 Antennae not biannulate; corium largely hyaline, without distinct transverse veinlets. 49. **gracilicornis** Stål
55. Genital lobes of female extending beyond second genital segment; male, fig. 47b 47. **abbas** Bergroth
 Genital lobes of female truncate, not extending beyond apex of second genital segment (fig. 48a); male unknown . . . 48. **breviatus** Bergroth
56. Color brown, pronotum and corium extensively marked with yellow; length of second antennal segment equal to width of head between eyes. 50. **marginatus** Uhler
 Color black, pronotum concolorous; second segment longer. 57
57. Third antennal segment pale in apical third; corium not hyaline.
 51. **uniannulatus** sp. nov.
 Third segment entirely black; corium largely hyaline.
 52. **evermanni** Van Duzee
58. Antennae thicker than front femora; postocular tubercles obsolete. . . 59
 Antennae more slender than front femora; postocular tubercles distinct.
 60. **heidemanni** Bergroth

59. Length of second antennal segment about equal to two-thirds width of head between eyes; third segment enlarged toward apex; sides of scutellum feebly elevated; length of female less than 7 mm.

58. **niger** Stål

Length of second segment more than three-fourths width of head between eyes; third cylindrical; sides of scutellum moderately but distinctly elevated; length of female more than 7 mm.

59. **nigrinus** sp. nov.

Subgenus **Aradus** Fabricius, Stål

1873. *Aradus (Aradus)* Stål, Enum. Hem., 3, p. 135.

Rostrum extending beyond base of head; pronotum of varied form, the lateral margins more or less explanate. This subgenus contains a great majority of the species of *Aradus*, among which are several that in certain respects form connecting links with *Quilnus*. The group *Piestosoma* Laporte is not represented among our species, in my opinion (see, p. 17), and therefore we are not concerned here with the question whether it is a good subgenus, as listed by Van Duzee,⁶ or a minor group under the subgenus *Aradus*, as Bergroth⁷ and Kiritshenko⁸ have it.

1. **Aradus (Aradus) aequalis** Say (Plate I, fig. 1.)

1832. *Aradus aequalis* Say, Het. Hem., p. 29; Compl. Writ. II, p. 352.

1903. *Aradus duryi* Osborn, Ohio Nat., IV, p. 39.

Distribution.⁹—QUEBEC: Montreal Island, V, 8, 1904. ONTARIO: Prince Edward County (Brimley). MAINE. VERMONT (P. S. Sprague). NEW YORK: Ithaca, IV, 25, 1913 (C. P. Alexander); McLeab, V, 31, 1913. PENNSYLVANIA: Inglenook, V, 12, 1911 (H. B. Kirk); Wilmerding (M. Wirtner). DISTRICT OF COLUMBIA: Washington, IV, 2, 1905 (O. Heidemann). MARYLAND. VIRGINIA: Dead Run, IV, 21, 1916 (R. C. Shannon); near Plummer's Island, VI, 4, 1916 (R. C. Shannon). OHIO: Cedar Point; Cincinnati, IV, 30 (C. Dury); Cleveland (Hoff); Lancaster, V, 13, 1905 (T. P. White). ILLINOIS. [OKLAHOMA. TEXAS.]

Description.—Brown; broad lateral margins and posterior region of pronotum, margins of scutellum at middle, basal expansions of corium and neighboring veins, posterior margins of connexival segments, and inner margins of

⁶ Catal. Hemip., p. 135, 1917.

⁷ Canad. Ent., xxxviii, p. 198, 1906.

⁸ Faune Russic. Ins., Hemip., vi, livr. 1, p. 58, 1913.

⁹ The records are taken almost entirely from specimens which I have studied. In the few cases where I have borrowed published data, the fact is indicated by square brackets.

genital lobes, yellowish; membrane with irregularly reticulate pale markings; legs yellow, femora and tibiae with broad brown band at middle.

Head about equal in length and breadth, slightly shorter than pronotum on median line; tylus short, its sides parallel; impressions of vertex elongate, diverging anteriorly; preocular tubercles distinct; antenniferous spines stout, moderately divergent, without lateral tooth; postocular tubercles obsolescent; antennae (fig. 1c) moderately slender, cylindrical, somewhat shorter than head and pronotum together, the first segment reaching middle of tylus, the second about as long as distance between eyes; rostrum extending a little beyond base of prosternum. Pronotum (fig. 1d) with lateral margins very finely crenulate; median carinae strongly elevated. Scutellum longer than pronotum (45 to 33), elongate, triangular, with short median carina at base; lateral margins scarcely elevated. Hemelytra (♂) extending nearly to apical angles of sixth abdominal segment, connexivum moderately exposed, corium reaching beyond middle of fourth segment; hemelytra (♀) to genital segment, connexivum broadly exposed, corium to base of fourth; exocorium very strongly expanded at base; mesocorium with two or three distinct transverse veins, endocorium with one or two. Abdomen ovate, broad, the lateral margins almost entire.

♂ (fig. 1b). Fifth ventral segment one-half as long as sixth; genital segment short, moderately convex. Length, 8.4 mm.

♀ (fig. 1a). Posterior margin of dorsal genital segment truncate at middle. Length, 9 to 10 mm.

Type specimens (Indiana) lost.

This large and rare species is easily distinguished by antennal, pronotal, and genitalic structure. It is normally fully winged, but one specimen in the Cornell University collection is incipiently brachypterous. The hemelytra are moderately narrowed and shortened, considerably less so than in *intectus* (fig. 12d), and extend nearly to the posterior margin of the fifth abdominal segment; the corium is little modified except in length, extending somewhat beyond the middle of the third segment; the membrane is about half the normal size, with somewhat reduced venation. Short hind wings are present and the posterior lobe of the pronotum exhibits a slight flattening.

2. *Aradus* (*Aradus*) *crenatus* Say (Plate I, fig. 2.)

1832. *Aradus crenatus* Say, *Het. Hem.*, p. 28; *Compl. Writ.*, II, p. 350.

Distribution.—QUEBEC: Hemmingford, VIII, 30, 1916 (J. I. Beaulne); Montreal, VIII, 1901. ONTARIO: Grimsby; Ottawa, IX, 23, 1907 (C. H. Young); Preston (H. Groh); Ridgeway (Kilman). NEW YORK: Catskill; Ithaca, V, 22, 1914; Keene Valley, Adirondacks, IX, 1917 (G. P. Engelhardt);

Roslyn, Long Island; West Point, VI, 3, 1911 (W. T. Davis). PENNSYLVANIA: Erie, VII, 1903 (M. Wirtner); Greensburg (Wirtner); Wilmerding (J. L. Zabriskie). DISTRICT OF COLUMBIA: Washington, I, 4, 1898 (O. Heidemann). MARYLAND: Cabin John, IV, 1908 (W. Palmer); Glen Echo, X, 18, 1901 (O. Heidemann); Plummer's Island, V, 18, 1905 (Barber & Schwarz). VIRGINIA: Dyke, V, 18, 1917 (A. Wetmore); Fortress Monroe, IV, 19, 1891 (H. Barber). NORTH CAROLINA: Black Mountains, V, 10; Tryon, IV, 4, 1903 (W. F. Fiske). GEORGIA: Atlanta. [ALABAMA.] MICHIGAN: Detroit, V, 1874; Washtenaw County, X, 1, 1916 (F. M. Gaige). OHIO: Cincinnati, VI, 13, 1902 (C. Dury); Columbus; Flint, IV, 10, (R. J. Sim); Jefferson, VIII, 17, 1915 (R. J. Sim); Old Fort, XI, 27, 1915. ILLINOIS: Chicago (C. T. Brues); Homer IV, 27, 1907 (C. A. Hart); Urbana IV, 14, 1907 (C. A. Hart). INDIANA. [MEXICO, Bergroth.] PALAEARCTIC REGION.

Description.—Dark to light brown; pronotum with irregular darker markings especially on median carinae, postero-lateral areas, and sometimes on anterior explanate margins; scutellum with dark brown markings, the sides pale at middle, or sometimes wholly black; corium dark along inner apical margin; connexival segments with a triangular patch of dark granules anteriorly and a smaller one posteriorly; sutures of abdominal segments black; antennae yellowish; legs yellowish, the femora and tibiae with broad medial and narrow apical or subapical dark annulations; ventral surface reddish brown, with paler mottling.

Head a little longer than broad (48 to 43), as long as pronotum; tylus short, broad, the sides parallel; impressions of vertex rather short, deep, almost parallel; preocular tubercles distinct, rather acute; antenniferous spines short, conical, moderately divergent, with distinct lateral tooth; antennae (fig. 2c) slender, cylindrical, shorter than head and pronotum together (80 to 91), the first segment extending well beyond middle of tylus, the second as long as distance between eyes; rostrum extending somewhat beyond middle of prosternum. Pronotum (fig. 2d) with lateral margins widely expanded and moderately reflexed, with irregular teeth anteriorly and fine ones posteriorly; carinae well elevated; transverse depression distinct; surface smooth posteriorly between carinae. Scutellum narrow, slightly longer than pronotum (50 to 18); sides strongly elevated, nearly parallel in basal third, then sinuate to acute apex; basal portion of disc very slightly elevated, with low median carina. Hemelytra (σ) strongly narrowed from basal expansion to apex, disclosing abdominal disc at sides, extending to genital lobes, corium extending somewhat beyond middle of fourth segment; hemelytra (φ) similarly narrowed, reaching dorsal genital segment, corium to or somewhat beyond apex of third. Abdomen oval, broader in female, lateral margins variably crenate.

σ (fig. 2b). Fifth and sixth ventral segments about equal in length; genital segment short, slightly convex, carinate, the lobes long. Length, 8 to 9 mm.

φ (fig. 2a). Dorsal genital segment semicircular, the posterior margin almost straight. Length, 9.5 to 11 mm.

Type specimens (United States) lost.

A species of wide distribution, sometimes locally common, distinguished by its large size, antennal structure, strongly crenate abdomen, and very coarse granulation. Sometimes taken in sifting the rotten wood of dead stumps. Comparison with numerous European specimens discloses no differences of specific value.

3. *Aradus (Aradus) quadrilineatus* Say (Plate 1, fig. 3.)

1825. *Aradus quadrilineatus* Say, Journ. Acad. Nat. Sci. Philadelphia, iv, p. 326; Compl. Writ., ii, p. 249.

Distribution.—QUEBEC: Hudson, V, 22, 1915 (J. I. Beaulne); Montreal Island, V, 21, 1904; Ottawa, VIII, 8, 1912; Val Morin. ONTARIO: Grimsby; Picton, V, 27, 1901 (J. D. Evans); Toronto, IV, 24, 1898 (E. P. Van Duzee). MAINE: Holden, VI, 17, 1902 (F. A. Eddy); Monmouth (O. O. Stover); Mount Katahdin, VIII, 19, 1902 (H. G. Barber); Orono, V, 20, 1914; Paris, VII, 10, 1914 (C. A. Frost). NEW HAMPSHIRE: Claremont; Concord; Durham; Franconia (A. T. Slosson); Mount Washington, Glen House, IX, 22, 1907 (O. Bryant), summit, (A. T. Slosson); Webster (W. F. Fiske). MASSACHUSETTS: Amherst; Boston, IV, 30, 1903 (H. M. Parshley); Leeds, IV, 6, 1919 (J. R. de la Torre-Bueno and H. M. P.); Natick, XI, 1, 1900. RHODE ISLAND: Providence, V, 7, (C. A. Davis); Warwick, V, 26. CONNECTICUT: Hartford, V, 11, 1914 (W. Marchand); Saybrook, IV, 25, 1913 (D. J. Caffrey); S. Meriden, V, 10, 1914 (H. L. Johnson). NEW YORK: Buffalo, X, 27, 1901 (E. P. Van Duzee); Clove Valley, Staten Island, V, 6, 1916 (W. T. Davis); Colden, V, 30, 1902 (E. P. Van Duzee); Fort Montgomery, V, 30, 1903; Hamburg, VI, 21, 1908 (E. P. Van Duzee); Ithaca, IV, 5, 1910 (C. R. Plunkett); Lake George, VII, 9, 1905 (J. L. Zabriskie); Niagara Falls, IV, 25, 1909 (E. P. Van Duzee); Schenectady, VIII, 22, 1908; Slootsburg, XI, 8, 1914; Southfields, V, 3, 1914 (F. M. Schott); West Point, VI, 4, 1911 (W. T. Davis); Whiteface Mountain, top, VII, 10, 1914 (W. T. Davis); White Plains, IV, 11, 1914 (J. R. de la Torre-Bueno); Rockaway Beach, Long Island, V, 25, 1912 (H. G. Barber). NEW JERSEY: Overbrook, V, 30, 1907; Plainfield, IV, 26 (A. Nicolay); Roselle Park, V, 3, 1914 (H. G. Barber); Schooley's Mountains, Hackettstown, V, 21, 1910; Summit, X, 26, 1913 (F. M. Schott); Vineland, IV, 25 (H. B. Weiss). PENNSYLVANIA: Greensburg (M. Wirtner); Jeanette; North Mountain, IX, 2 (C. W. Johnson); Pittsburg, VIII, 1905. DISTRICT OF COLUMBIA: Brightwood, IV, 5, 1903 (O. Heidemann). MARYLAND. VIRGINIA: Warm Springs, X, 1900 (W. T. Davis); West Falls Church (N. Banks). NORTH CAROLINA. [FLORIDA.] LOUISIANA: Opelousas, V. MICHIGAN: Steere, Washtenaw County, V, 14, 1919 (R. F. Hussey). OHIO: Cedar Point; Columbus, IV, 6, 1913 (H. Osborn); Jefferson, VIII, 17, 1915 (R. J. Sim); Old Fort, X, 27, 1915. INDIANA: Hessville, V, 3, 1909 (W. J. Gerhard); Mineral Springs, X, 2, 1910

(W. J. Gerhard). ILLINOIS: Algonquin, V, 6, 1897 (C. A. Hart); Glen Ellen, VI, 18, 1905 (A. B. Walcott); Muncie, IV, 29, 1905 (C. A. Hart); Palos Park, VI, 20, 1909 (W. J. Gerhard). IOWA: Ames (H. Osborn). MANITOBA: Aweme, V, 9, 1915 (N. Criddle). WISCONSIN: Beaver Dam, VI, 17, 1911 (W. E. Snyder). MISSOURI. KANSAS: Douglas County, V (E. S. Tucker). ALBERTA: Edmonton, V, 9, 1919 (F. S. Carr). NORTHWEST TERRITORY: Great Bear Lake. PANAMA.

Description.—Dark brown to black, apex of second antennal segment and posterior connexival angles pale; membrane black, with irregular reticulate white markings; trochanters pale; tibiae with apical and subbasal, and femora with subapical pale rings; ventral surface brown, with lateral pale marks and light spiracles.

Head very slightly longer than broad, slightly longer than pronotum; tylus rather broad, the sides parallel; impressions of vertex elongate, parallel; preocular tubercles obsolescent; antenniferous spines moderately acute, slightly divergent, the lateral tooth slight or absent; postocular tubercles obsolescent; antennae (fig. 3c) moderately robust, somewhat shorter than head and pronotum together, the first segment extending beyond middle of tylus, the second shorter than distance between eyes (22 to 25); rostrum reaching base of prosternum. Pronotum (fig. 3d) with lateral margins finely and irregularly denticulate, widely expanded, reflexed; carinae strongly elevated. Scutellum longer than pronotum (45 to 30), elongate, triangular, sides strongly raised. Hemelytra extending (σ^7) to apical angles of sixth abdominal segment, ($\varnothing$) to middle of dorsal genital segment; corium almost or quite to middle of fourth segment; exocorium moderately expanded at base, mesocorium with one, endocorium without well developed transverse veins; connexivum broadly exposed. Abdomen oval, moderately crenate.

σ^7 (fig. 3b). Fifth ventral segment as long as sixth; genital segment moderately convex. Length, 7.5 to 8 mm.

$\varnothing$ (fig. 3a). Posterior margin of dorsal genital segment very slightly emarginate at middle. Length, 8 to 9 mm.

Type specimens (Missouri) lost.

This is a common and widely distributed species of large size, distinguished especially by antennal and genitalic structure. An occasional specimen exhibits incipient brachyptery, having the hemelytra about twice as long as the scutellum, venation distinct, short hind wings present, and the pronotum a little depressed before base of scutellum.

4. *Aradus (Aradus) ampliatus* Uhler (Plate I, fig. 4.)

1876. *Aradus ampliatus* Uhler, Bull. U. S. Geol. Geog. Surv., 1, p. 321.

1893. *Aradus ampliatus* Uhler, Proc. Ent. Soc. Washington, 11, p. 381.

Distribution.—[UTAH: Alta, VII, 1, 1891 (E. S. Schwarz) *sec.* Uhl.] CALIFORNIA: Placer County, IV, 1905; Sierra (J. Behrens).

Description.—Opaque black; third antennal segment in apical half bright orange; apical angles of comexival segments and inner half of genital lobes with narrow margin of dorsal genital segment at middle, reddish yellow; legs black, the coxae, base and sub-apical ring of femora, apex of tibiae, and tarsi brownish yellow; rostrum and most of ventral surface dark reddish brown.

Head slightly longer than broad (40 to 38), about equal in length to pronotum; tylus short, tapering in apical half; impressions of vertex deep, divergent; preocular tubercles very large, conical, moderately acute; antenniferous spines rather short, slender, moderately divergent, with very small lateral tooth; postocular tubercles rough, prominent, acute; antennae (fig. 4c) moderately slender, cylindrical, slightly longer than head and pronotum together (85 to 80), the first segment extending well beyond middle of tylus, the second almost as long as width of head including eyes; rostrum extending over anterior fourth of mesosternum. Pronotum (fig. 4d) rather flat, lateral margins finely and irregularly denticulate, broadly expanded and reflexed; carinae very strongly elevated. Scutellum elongate, triangular, much longer than pronotum (65 to 40); sides strongly elevated except toward apex, nearly straight, more strongly convergent in apical fourth; apex obtuse; basal portion of disc slightly and unevenly elevated. Hemelytra (♀) moderately narrowed, exposing a little of abdominal disc at sides, extending to middle of dorsal genital segment, the corium to base of fourth; exocorium widely and evenly expanded and reflexed at base; mesocorium and endocorium with one or two distinct transverse veins; membrane with very few cross-veins. Abdomen broadly ovate.

♂. Unknown.

♀ (fig. 4a). Posterior margin of dorsal genital segment straight; genital lobes very short, transverse, as viewed from above. Length, 11 to 11.3 mm.

Type specimen (Sierra, California) in the Uhler Collection, U. S. N. M., No. 24078, lectotype.

One of our largest and handsomest species, of which only a few specimens exist in collections. Coloration, antennal structure, and the female genitalic characters provide ready means of identification.

5. *Aradus (Aradus) montanus* Bergroth (Plate I, fig. 5.)

1913. *Aradus montanus* Bergroth, Can. Ent., XLV, p. 1.

Distribution.—QUEBEC: St. Hilaire, VI. COLORADO: Leadville, 10,000 to 11,000 ft., VII, 7 to 14, 1896 (H. F. Wickham).

Description.—Black or brownish black.

Head as long as broad, slightly longer than pronotum (32 to 29); tylus rather short, enlarged toward base; impressions of vertex short and broad, rather shallow, parallel; preocular tubercles very small, obtuse; antenniferous spines short, evenly conical, moderately divergent, with distinct lateral tooth; postocular tubercles prominent, acute; antennae (fig. 5c) moder-

ately robust; shorter than head and pronotum together (54 to 62), the first segment reaching apical third of tylus, the second slightly shorter than distance between eyes (20 to 21); rostrum extending slightly beyond middle of prosternum, the apical segment slender. Pronotum (fig. 5d) rather flat, the lateral margins irregularly and finely crenulate, well expanded and a little reflexed; carinae slightly elevated. Scutellum elongate, much longer than pronotum (48 to 30), sides straight and slightly convergent to apical third, then slightly arcuate to rather broad apex, not strongly elevated; basal two-fifths of disc slightly elevated, with very low median carina extending nearly to middle. Hemelytra (♀) but slightly narrowed toward apex, extending to middle of dorsal genital segment, corium to base of fourth; exocorium moderately expanded and reflexed at base; mesocorium with one, endocorium without distinct transverse veins.

♂. Unknown.

♀ (fig. 5a). Posterior margin of dorsal genital segment transverse, with a rather deep rounded notch at middle; abdomen rather broad, oblong-oval, widest at fourth segment. Length, 8.3 mm.

Type specimen (Leadville, Colorado) in Bergroth's collection.

Of this species but two specimens are known, the type, which I have examined, and a perfectly similar example from Quebec, in my collection. In describing the species Bergroth (1913) writes: "A plain-looking species, but not closely allied to any described North American form." It is peculiar in color and all structural characters and forms one of the isolated groups which it seems necessary to place at the head of the genus.

6. *Aradus* (*Aradus*) *ornatus* Say (Plate I, fig. 6.)

1832. *Aradus ornatus* Say, *Het. Hem.*, p. 29; *Compl. Writ.*, II, p. 352.

1892. *Aradus ornatus* Bergroth, *Proc. Ent. Soc. Washington*, II, pp. 332, 334.

Distribution.—PENNSYLVANIA. DISTRICT OF COLUMBIA: Washington, V, 26, 1897 (O. Heidemann). MARYLAND: Plummer's Island, VII, 15, 1907 (E. A. Schwarz). VIRGINIA. OHIO: Cincinnati (C. Dury). INDIANA.

Description.—Dark brown, the hemelytra except clavus and the abdomen pale; head, disc of pronotum anteriorly, and base of scutellum covered with brown granules; posterior portion of pronotum polished black between the carinae; extreme apex of scutellum usually yellow; corium yellowish white, with narrow lateral margin or submargin and apex dark brown, and a few small, scattered dark spots; clavus brown; membrane yellowish white with faint maculation; abdomen pale reddish yellow, a narrow submarginal stripe and apical half of genital lobes dark brown; rostrum pale, the apex darker; legs yellowish or pale reddish, femora and tibiae with broad dark ring at middle; ventral surface of abdomen pale, the disc darker anteriorly, a few small spots and interrupted median vitta brown.

Head broader than long (28 to 25), longer than pronotum (25 to 22); tylus short, slightly narrowed from base to apex; impressions of vertex short, triangular; preocular tubercles obsolete; antenniferous spines very stout, conical, very slightly divergent, without lateral tooth; postocular tubercles very low, rounded; antennae (fig. 6c) very robust, shorter than head and pronotum together (42 to 47), the first segment extending to apex of antenniferous spines and well beyond the middle of tylus, the second shorter than distance between eyes (47 to 20); rostrum extending to middle of prosternum. Pronotum (fig. 6d) with lateral margins crenulate and but slightly reflexed; carinae strongly raised, the surface between them without granules posteriorly. Scutellum longer than pronotum (26 to 22), broadly triangular, sides straight, moderately elevated; a slightly elevated transverse carina at base. Hemelytra (σ^1) nearly parallel beyond middle, narrower than disc of abdomen, extending to middle of genital lobes; (φ) a little broader, extending to middle of dorsal genital segment; corium reaching about to middle of fourth; exocorial dilation extreme, almost semicircular; mesocorium with one, endocorium without well defined transverse veins. Abdomen broadly oval, sides notched, not crenate.

σ (fig. 6b). Fifth ventral segment as long as sixth; genital segment strongly convex, the lobes rather short. Length, 5.4 mm.

φ (fig. 6a). Posterior margin of dorsal genital segment straight, transverse. Length, 6 to 6.3 mm.

Type specimens (Indiana) lost.

This rare species is one of the most beautiful of the American forms; as Say remarks, it is well distinguished by the polished pronotal spots and by its coloration. Bergroth (1892) was the first modern author to recognize it.

7. *Aradus* (*Aradus*) *coarctatus* Heidemann (Plate I, fig. 7.)

1907. *Aradus coarctatus* Heidemann, Proc. Ent. Soc. Washington, VIII, p. 69.

Distribution.—CALIFORNIA: Cazadero, Sonoma County, IV, 14, 1918, IX, 7, 1918 (E. P. Van Duzee); Los Angeles (D. W. Coquillett); Mountains near Claremont (C. F. Baker).

Description.—Dark brown, narrow posterior margins of pronotal lobes, basal expansions except margin, and cells, in large part, of corium, and extreme apex of scutellum, yellowish; connexivum with outer half, or at least apical angles of segments, dull reddish yellow; inner margins of genital lobes narrowly pale; legs brown, the femora and tibiae pale at base and apex; ventral surface of abdomen reddish brown, with rows of small spots and base of genital segment pale; membrane brown, the veins and veinlets white.

Head as long as broad, longer than pronotum (24 to 20); tylus rather narrow, the sides nearly parallel; impressions of vertex short, deep, slightly divergent anteriorly, connected by a posterior depression; preocular tubercles distinct, acute; antenniferous spines stout, conical, with distinct

lateral tooth; postocular tubercles obtuse; antennae (fig. 7c) roughly scabrose, very robust, almost as long as head and pronotum together (40 to 44), the first segment extending to middle of tylus, the second as long as distance between eyes; rostrum extending to base of prosternum. Pronotum (fig. 7d) rather flat, sides with coarse teeth anteriorly; carinae strongly elevated, coarsely granulate. Scutellum longer than pronotum (29 to 20), rather broadly triangular, sides straight, parallel at extreme base, strongly and sharply elevated; basal elevation transverse, narrow, sharply marked off from the depressed disc. Hemelytra (♂) extending to base of genital segment, narrowed from basal expansion, exposing disc of abdomen at sides; corium extending to middle of fourth; exocorium moderately but distinctly dilated; mesocorium with one, endocorium without distinct transverse veins, but somewhat roughened.

♂ (fig. 7b). Fifth ventral segment about as long as sixth; genital segment strongly convex, the lobes short. Abdomen broadly obovate, widest behind the middle, sides with minute notches. Length, 4.1 to 4.6 mm.

♀. Unknown.

Type specimen (California), United States National Museum, No. 9867; paratypes, United States National Museum and Cornell University collection.

This species, somewhat related to *ornatus*, is readily distinguished by its small size, very robust antennae, coloration, and pronotal structure. It has been found very seldom.

8. *Aradus (Aradus) fuscomaculatus* Stål (Plate I, fig. 8.)

1859. *Aradus fuscomaculatus* Stål, Freg. Eugen. Resa, Ins. Hem., p. 260.

1873. *Aradus fuscoannulatus* Stål, Enum. Hem., 3, p. 136.

Distribution.—BRITISH COLUMBIA: Departure Bay, VI, 6, 1908 (G. W. Taylor); Malahat, V, 29, 1917 (R. C. Treherne); North Bend, VI, 7; Victoria, Vancouver Island. WASHINGTON: Hoquiam (Burke); Tenino, V, 29, 1893. OREGON: Dilley. CALIFORNIA: Big Basin Rock, Santa Cruz County, V, 12, 1918 (L. S. Slevin); Carmel, IV, 20, 1918 (L. S. Slevin); Fieldbrook, V, 26, 1903 (H. S. Barber); Lagunitas, IV, 24, 1910 (E. C. Van Dyke); Mount Tamalpais, Marin County, IX, 19, 1909 (E. C. Van Dyke); Santa Cruz Mountains; Sonoma County.

Description.—Brown, with variable pale yellowish markings on expanded margins of pronotum and on corium especially at base; posterior ends of median carinae and sometimes narrow postero-lateral margins of pronotum, and extreme apex of scutellum, yellow; second antennal segment rarely a little yellowish at base and apex; depressed portion of scutellum black; connexivum irregularly variegated, the posterior and extreme lateral margins and sometimes most of disc of connexival segments yellowish; membrane with more or less conspicuous white reticulation; inner margins of genital lobes yellow; legs brown, the coxae, trochanters, subapical ring of femora

and basal and apical rings of tibiae, yellowish; sternum and most of ventral surface of abdomen reddish brown.

Head as long as broad, longer than pronotum (30 to 24); tylus moderately compressed, slightly enlarged at middle; impressions of vertex elongate, deep, parallel; preocular tubercles distinct; antenniferous spines moderately stout and divergent, the lateral tooth slight or absent; postocular tubercles of moderate size; antennae (fig. 8c) robust, almost as long as head and pronotum together (48 to 53), the first segment reaching middle of tylus, the second about as long as distance between eyes; rostrum extending beyond apex, sometimes almost to middle of mesosternum. Pronotum (fig. 8d) with sides finely crenulate, bearing anteriorly a few large teeth which may be obsolescent; carinae well elevated, rather roughly granulate. Scutellum longer than pronotum (36 to 24), triangular, with distinct transverse elevation at base; sides strongly elevated and sometimes very slightly curved. Hemelytra (σ) extending to genital lobes, (φ) to middle of dorsal genital segment, narrowed (σ φ), exposing disc of abdomen at sides, corium nearly to base of fourth; exocorium moderately expanded; mesocorium with one, endocorium without distinct transverse veins. Abdomen broadly ovate, the lateral margins entire.

σ (fig. 8b). Fifth ventral segment about as long as sixth; genital segment moderately convex. Median carinae of pronotum less strongly divergent at base than in female. Length, 5.5 to 6 mm.

φ (fig. 8a). Posterior margin of dorsal genital segment nearly straight at middle; genital lobes projecting considerably as viewed from above. Length, 6.5 to 6.7 mm.

Type specimens (California) probably in the Stockholm Museum.

This distinctively western species is distinguished from allied forms by its coloration, details of antennal and pronotal structure, and the genital characters. It seems to be moderately common on the Pacific Coast.

9. *Aradus* (*Aradus*) *pannosus* Van Duzee (Plate I, fig. 9.)

1920. *Aradus pannosus* Van Duzee, Proc. California Acad. Sci. (4), ix, p. 332.

Distribution.—CALIFORNIA: Berkeley, I, 8, 1919 (H. Dietrich), II, 2, 1915 (E. P. Van Duzee); Marin County, XII, 27, 1915 (H. Dietrich).

Description.—Dark brown, variegated about as in the preceding; second antennal segment with a broad yellow ring at apex.

Head about as long as broad, longer than pronotum (28 to 22); impressions of vertex rather broad, slightly divergent anteriorly; preocular tubercles distinct; antenniferous spines short, very stout, moderately divergent, the lateral margin irregular; postocular tubercles slightly developed; antennae (fig. 9c) robust, shorter than head and pronotum together (40 to 48), the first segment reaching middle of tylus, the second slightly longer than distance

between eyes (20 to 19); rostrum extending over anterior fourth of mesosternum. Pronotum (fig. 9d) with lateral margins finely crenulate posteriorly, a few large teeth anteriorly; carinae strongly elevated. Scutellum longer than pronotum (35 to 22), structure as in the preceding except that the disc is less strongly depressed. Hemelytra about as in the preceding.

♂ (fig. 9b). Fifth ventral segment about as long as sixth; genital segment short, moderately convex, the lobes rather long; abdomen broadly obovate, widest well behind middle, margins entire. Length, 5.5 mm.

♀ (fig. 9a). Posterior margin of dorsal genital segment sinuate, shallowly emarginate at middle; genital lobes short as viewed from above; projecting a distance less than one-half their breadth; abdomen almost circular, apices of the segments a little prominent; connexival segments transversely ridged. Length, 6 mm.

Type specimen (Berkeley, California) in the collection of the California Academy of Sciences.

This Californian species, while rather closely related to *fuscumaculatus*, is well distinguished by the proportions of the antennal segments, by its genital characters, and, in the typical form, by the coloration of the antennae.

Aradus pannosus variety **incomptus** var. nov.

Like the typical form except in the absence of the apical ring of the second antennal segment.

Holotype.—♀; Marin County, California, XI, 8, 1919 (H. Dietrich), in my collection.

Paratypes.—Females; same data as holotype, and XII, 27, 1919, in my collection.

This is a well-marked form of true varietal rank, since it occurs in the same region as the typical and exhibits intergradation, as indicated by one of the paratypes which shows slight traces of pale color at the apex of the second antennal segment.

10. Aradus (Aradus) behrensi Bergroth (Plate I, fig. 10.)

1886. *Aradus Behrensi* Bergroth, Wiener Ent. Zeit., v, p. 97.

Distribution.—BRITISH COLUMBIA: Malahat, V, 29, 1917 (R. C. Treherne); Yale, V, 26, 1918 (W. Downes). WASHINGTON: Tenino, V, 29, 1893; Olympia. OREGON: Corvallis, VII, 1917 (R. H. Smith); Hood River, V, 20, 1893. CALIFORNIA: Cazadero, IX, 2, 1918 (E. P. Van Duzee); Cisco, VII, 1911 (C. von Geldern); San Diego County, IX, 4, 1913 (E. P. Van Duzee); Upper Soda Springs, Shasta County (J. Behrens).

Description.—Brown to brownish black; first antennal segment, spots on basal expansion of corium and sometimes a few of the veins, extreme apex of scutellum, apical angles and sometimes apical margins of connexival seg-

ments, and narrow inner margins of genital lobes, pale reddish or yellowish brown; membrane dark, paler at base and sometimes along some of the veins; rostrum and legs paler, femora with broad median and narrow apical dark rings, tibiae with broad median dark band; ventral surface of abdomen dark brown, with obscure paler spots.

Head slightly broader than long (28 to 27), longer than pronotum (27 to 23); tylus rather short, enlarged at middle and again toward base; impressions of vertex rather broad, more or less distinctly semilunate, connected posteriorly; preocular tubercles distinct, obtuse or rarely subacute; antenniferous spines very short and stout, conical, the lateral tooth minute or absent; postocular tubercles obtuse, rounded; antennae (fig. 10c) moderately robust, minutely and evenly granulate, almost as long as head and pronotum together, the first segment extending a little beyond middle of tylus, the second as long as distance between eyes; rostrum extending about to base of prosternum. Pronotum (fig. 10d) with lateral margins rather strongly expanded and moderately reflexed, the lateral teeth usually coarse, variable, rarely almost obsolete; carinae distinctly elevated. Scutellum of rather variable shape, more or less distinctly pentagonal, broad, much longer than pronotum (35 to 23), sides moderately elevated, apex acute or rather obtuse; basal elevation transverse, obtusely carinate, extended a little posteriorly at middle. Hemelytra (σ) extending to base of genital lobes, rather broad, covering abdominal disc, (φ) reaching about to middle of dorsal genital segment, more strongly narrowed; corium extending about to middle of fourth connexival segment; exocorium moderately expanded, mesocorium with one, endocorium with one to several distinct transverse veins.

σ (fig. 10b). Fifth ventral segment slightly longer than sixth (14-10); genital segment short, strongly convex, the lobes short, truncate; abdomen oval. Length, 5.2 to 5.7.

φ (fig. 10a). Posterior margin of dorsal genital segment shallowly emarginate at middle; abdomen broadly oval, sometimes almost circular. Length, 6 to 7 mm.

Type specimens (Upper Soda Springs, California) in Bergroth's collection.

This Pacific Coast species, the types of which Dr. Bergroth has kindly sent to me for study, is variable in details of coloration and of pronotal and scutellar structure, as well as in the shape of the female abdomen. It is readily distinguished from close allies by the structure of the antennae, general shape of the pronotum, and genitalic features. Van Duzee¹⁰ describes two incipiently brachypterous examples, in which the hemelytra extend to the base of the fifth abdominal segment.

¹⁰ Univ. of Cal., Tech. Bulls., Ent., 1, p. 233, 1916.

11. *Aradus (Aradus) robustus* Uhler (Plate II, fig. 11.)

1871. *Aradus robustus* Uhler, Proc. Boston Soc. Nat. Hist., xiv, p. 104.

Distribution.—QUEBEC: St. Hilaire, V, 24, 1906 (G. Beaulieu). ONTARIO: Prince Edward County, V, 28, 1916 (J. F. Brinley); Ridgway (Kilman). MAINE: Manchester (O. O. Stover); Monmouth, VI, 27, 1901 (C. A. Frost); Orono, IV, 24, 1914 (H. M. Parshley). NEW HAMPSHIRE: Three Mile Island, V, 27, 1908 (F. Blanchard). MASSACHUSETTS: Cambridge, X, 12; Forest Hills, V, 26, 1916 (A. M. Wilcox); Holyoke, XI, 12, 1903 (F. Knab); Milton, V, 20, 1829 (Harris Coll.); Northampton, V, 4, 1919 (H. M. Parshley). NEW YORK: Huntington, Long Island, II, 23, 1913 (F. M. Schott); Long Beach, Long Island, V, 7, 1911 (J. R. de la Torre-Bueno); Batavia, V, 17, 1914 (H. H. Knight); Colden, V, 5, 1901 (E. P. Van Duzee); De Bruce, VII, 6, 1916 (W. T. Davis); Gowanda, VIII, 2, 1907 (E. P. Van Duzee); Fort Montgomery, V, 31, 1903; Ithaca, IV, 5, 1910 (C. R. Plunkett); Orleans County, VI, 4, 1916 (W. T. Davis); Whiteface Mountain, top, VII, 10, 1914 (W. T. Davis); White Plains, XII, 15, 1912 (J. R. de la Torre-Bueno). NEW JERSEY: Caldwell, IX, 5, 1914 (F. M. Schott); Camden, XI, 23; Fort Lee, VII; Roselle Park, V, 15, 1910 (H. G. Barber). PENNSYLVANIA: N. Cumberland, V, 5; Rockville, V, 27. DELAWARE. DISTRICT OF COLUMBIA: Washington, IV, 18, 1897 (O. Heidemann). MARYLAND: Plummer's Island, X, 8, 1905 (O. Heidemann). NORTH CAROLINA: Cape Hatteras, I, 1903 (F. Sherman). TENNESSEE. FLORIDA: Jacksonville. MICHIGAN: Agricultural College: Alma, V, 29, 1918 (L. A. Stearns). OHIO: Ashtabula County: Cincinnati, VI, 25, 1905 (C. Dury); Peebles, V, 16, 1903. INDIANA: Hessville, V, 30, 1909 (W. J. Gerhard). ILLINOIS: Havana, V, 17, 1912 (C. A. Hart); Urbana, IV, 11, 1892 (McElfresh); White Heath, III, 24, 1917 (C. A. Hart); Willow Springs, VI, 13, 1909 (W. J. Gerhard). WISCONSIN: Beaver Dam, VI, 12, 1911 (W. E. Synder). MINNESOTA: Minneapolis, V, 10, 1920 (R. F. Hussey). IOWA: Ames (H. Osborn). NORTH DAKOTA: Devil's Lake, VII, 22, 1920 (T. H. Hubbell). MISSOURI: Kansas City, IV, 28, 1897 (F. J. Hall). NEBRASKA: Ashland. KANSAS: Douglas County, V (F. H. Snow); Onaga, IV, 23, 1901 (Crevecoeur). TEXAS (Belfrage). NORTHWEST TERRITORY.

Description.—Nearly uniform dark brown; veins of corium and the membrane with very vague paler markings; tibiae with subbasal and subapical pale rings.

Head broader than long (30 to 25), equal in length to pronotum; tylus rather narrow; impressions of vertex triangular; preocular tubercles absent; antenniferous spines very large, stout, without lateral tooth; postocular tubercles large, rounded; antennae (fig. 11c) very robust, fusiform as a whole, a little shorter than head and pronotum together, the first segment reaching apex of antenniferous spines and a little beyond middle of tylus, the second shorter than distance between eyes (9 to 13); rostrum extending somewhat beyond middle of prosternum. Pronotum (fig. 11d) flat, the carinae slightly elevated. Scutellum longer than pronotum (32 to 25), pentagonal, the sides slightly elevated; disc transversely elevated at base. Hemelytra (♂) ex-

tending nearly to apex of abdomen, corium to apex of fourth connexival segment, (♀) to base of dorsal genital segment, corium to base of fourth; connexivum broadly exposed. Abdomen broadly oval.

♂ (fig. 11b). Fifth ventral segment somewhat shorter than sixth; genital segment short, strongly convex. Length, 5.5 to 6 mm.

♀ (fig. 11a). Posterior margin of dorsal genital segment very slightly emarginate at middle. Length, 6.5 to 7 mm.

Type specimen (Milton, Massachusetts), Harris Collection, No. 82, Boston Society of Natural History.

This common and widely distributed species is easily recognized by the very stout antennae, pronotal shape, and nearly uniform coloration, as well as scutellar and genitalic structure.

Aradus robustus variety **insignis** var. nov.

Similar to the typical form, except in coloration; pronotum dark brown, the granulation variable, light to dark, the postero-lateral margins pale yellowish; corium except apex and some variable markings, and apex of scutellum, yellowish; dorsal surface of abdomen reddish brown, of variable shade.

Holotype.—♀; Texas (Pergande Coll.), United States National Museum, No. 24072.

Allotype.—♂; Texas (Belfrage), United States National Museum.

Paratypes.—Females; Ashland, Nebraska, in my collection; Cape Hatteras, North Carolina, January, 1903 (F. Sherman), in North Carolina Experiment Station collection, Brownsville, Texas, XII, 16, 1911 (C. A. Hart), Illinois State Natural History Survey collection; Ann Arbor, Michigan, V, 24, 1919 (M. H. Hatch).

This variety is distinguished by its conspicuously variegated coloration, but is connected with the typical form by occasional specimens of the latter having the apex of the scutellum pale, etc. Although rare, there are enough examples known to indicate that it has no geographical significance.

12. Aradus (Aradus) intectus sp. nov. (Plate II, fig. 12.)

Description.—Blackish brown; chief veins of hemelytra, apex of scutellum, apical angles of connexival segments, and narrow inner margins of genital lobes, very obscurely pale; corium sometimes largely pale; rostrum and legs moderately light brown.

Brachypterous form.—Head about as broad as long, longer than pronotum (26 to 21); tylus somewhat narrowed from base to apex; impressions of vertex broad, shallow, ill-defined, connected posteriorly; base of head with

a narrow, smooth, pale, transverse lunule; preocular and postocular tubercles obsolescent; antenniferous spines very short and stout, conical, without lateral tooth, slightly divergent; antennae (fig. 12c) stout, about as long as head and pronotum together, the first segment extending a little beyond middle of tylus, the second almost as long as distance between eyes, slightly longer than third; rostrum extending to middle of mesosternum. Pronotum (fig. 12d) flattened, the lateral margins moderately expanded and reflexed, minutely granulate; carinae distinctly elevated. Scutellum (fig. 12d) narrow, longer than head (28 to 26), much longer than pronotum (28 to 21); sides moderately thickened and elevated except at extreme apex; disc with low rounded elevation before middle. Hemelytra (♀) (fig. 12d) narrowed and abbreviated, extending almost or quite to fifth abdominal segment in median line, corium to base of fifth.

♂. Unknown.

♀ (fig. 12a). Dorsal genital segment twice as wide as long, the posterior margin transverse, shallowly emarginate at middle between the distant genital lobes. Length, 6 mm.

Holotype.—♀; Fort Collins, Colorado (E. D. Ball), in the Heidemann collection, Cornell University, No. 550.1.

Paratype.—♀; Douglas, Wyoming, in American Museum of Natural History.

This species, of which only the brachypterous form is known, is related to *robustus* in the structure of the antennae and of the female genital plates, and to *duzei* in pronotal characters. It is very distinct in its particular combination of characters, especially in the form of the dorsal genital segment and genital lobes, as viewed from above (fig. 12c). In the group to which it belongs pterygo-polymorphic species are exceedingly rare.

13. *Aradus* (*Aradus*) *duzei* Bergroth (Plate II, fig. 13.)

1892. *Aradus Duzeei* Bergroth, Proc. Ent. Soc. Washington, II, p. 333.

Distribution.—QUEBEC: Montreal Island, IV, 15, 1906 (G. Beaulieu). ONTARIO: Muskoka (Van Duzee); Ridgeway (Van Duzee). MASSACHUSETTS: Northampton, V, 17, 1919 (Dorothy Merchant). NEW YORK: Ithaca; Rochester (G. Wendt). NEW JERSEY: Orange Mountains, V, 24, 1903 (H. G. Barber). PENNSYLVANIA: Inglenook, V, 19, 1912; Pittsburgh; Wilmerding (M. Wirtner). MARYLAND: Plummer's Island, V, 30, 1907 (W. L. McAtee). VIRGINIA: near Plummer's Island, V, 28, 1916 (W. L. McAtee). OHIO: Oxford; Worthington, V, 9, 1902 (J. G. Sanders).

Description.—Dark brown, extensively variegated with dull yellow; first antennal segment and rostrum pale; apex of scutellum, veins and basal expansion, except margin, and more or less of disc of corium, yellowish (these markings rarely indistinct); pronotum usually uniform brown, sometimes

translucent anteriorly on expanded margins and yellowish along narrow postero-lateral margins; posterior margins of connexival segments and broad inner margins of genital lobes yellowish; legs pale, the tibiae and femora sometimes with broad brown band at middle; ventral surface of abdomen brown, variably, and as a rule conspicuously, diversified with pale spots, especially on genital segments.

Head as long as broad, longer than pronotum (29 to 26); tylus narrow, compressed, slightly enlarged toward base; impressions of vertex deep, parallel, rather short, connected posteriorly; preocular tubercles distinct, obtuse; antenniferous spines stout, divergent, without lateral tooth; postocular tubercles low, rounded; antennae (fig. 13c) as long as head and pronotum together, the first segment extending beyond middle of tylus, the second as long as distance between eyes; rostrum reaching to or a little beyond middle of prosternum. Pronotum (fig. 13d) of characteristic form, lateral margins thickened, entire except for minute granulation, distinctly and broadly reflexed; carinae well elevated. Scutellum longer than pronotum (35 to 26), narrowly triangular, sides straight, convergent from base, moderately elevated; basal carina transverse, rounded, higher than sides beyond middle. Hemelytra (σ^7) parallel beyond middle, reaching middle of genital lobes; (φ) more or less narrowed, reaching base or middle of genital lobes; corium extending to middle or apex of fourth segment; exocorium strongly expanded, mesocorium and endocorium each with two or three distinct transverse veins. Abdomen oval, narrower in the male, margins almost entire.

σ^7 (fig. 13b). Fifth ventral segment shorter than sixth (11-14); genital segment short, very convex, the lobes long. Length, 6 mm.

φ (fig. 13a). Posterior margin of dorsal genital segment straight, slightly notched at middle. Length, 6.5-6.7 mm.

Type specimens (Muskoka, Ontario; Pennsylvania) in Bergroth's and Montandon's collections.

This fine species, easily recognized by pronotal and genital structure, has sometimes been considered as *ornatus* Say, according to Bergroth (1892), and Heidemann did not distinguish it from the western *apicalis*, recently described by Van Duzee. The western localities cited by Van Duzee¹¹ are based on a statement by Heidemann,¹² ". . . it is recorded from . . . California, and Colorado." I do not know the basis for this statement, but am strongly of the opinion that it rests upon the confusion mentioned above and is therefore erroneous. At any rate Heidemann's series of *duzei* contains specimens of *apicalis*, and the California collectors have so far failed to find the former in their territory.

¹¹ Catal. Hemip., p. 130, 1917.

¹² Proc. Ent. Soc. Wash., xii, p. 47, 1910.

14. *Aradus* (*Aradus*) *implanus* sp. nov. (Plate II, fig. 14.)

Description.—Brown; second antennal segment sometimes faintly yellowish at apex; pronotum with two translucent yellowish areas anteriorly on expanded margins; corium with extensive yellowish markings; extreme apex of scutellum yellow; posterior margins of connexival segments with dull reddish yellow bands, the inner margins of genital lobes yellow; legs brown, femora with basal and subapical pale rings, tibiae pale at base and apex; ventral surface of abdomen reddish brown with yellowish markings.

Head as long as broad, longer than pronotum (30 to 26); tylus rather short and thick, sides parallel; impressions of vertex broad, triangular, inner margins parallel; preocular and postocular tubercles rather low, obtuse; antenniferous spines short and stout, slightly incurved, divergent, without lateral tooth; antennae (fig. 14c) rather stout, about as long as head and pronotum together, the first segment reaching about to middle of tylus, the second slightly longer than distance between eyes; rostrum extending not quite to base of prosternum. Pronotum (fig. 14d) rather strongly convex posteriorly, lateral margins somewhat coarsely granulate but not serrate, distinctly reflexed; carinae strongly elevated. Scutellum longer than pronotum (30 to 26), rather narrowly triangular, the sides very strongly elevated to acute apex, higher than basal elevation, the latter transverse, occupying basal fourth of scutellum. Hemelytra (♂) nearly parallel beyond middle, extending nearly to apex of genital lobes, (♀) moderately narrowed toward apex, reaching middle of lobes; corium extending to apex of fourth segment, strongly expanded at base, with well developed transverse vein.

♂ (fig. 14b). Fifth ventral segment slightly shorter than sixth; genital segment moderately convex, the lobes long; abdomen broadly oval, widest behind middle, margins entire. Length, 5.8 to 6 mm.

♀ (fig. 14a). Posterior margin of dorsal genital segment almost straight; abdomen oval, margins decidedly crenate. Length, 6.3 mm.

Holotype.—♂; Trenton, Ontario, VI, 18, 1907 (J. D. Evans), in the National Collection at Ottawa.

Allotype.—♀; Montreal Island, IV, 15, 1906 (G. Beaulieu), in my collection.

Paratypes.—Males; Pittsburgh, Pennsylvania, in the Heide-
mann collection at Cornell University, No. 551.1; Funk's Grove,
Illinois, IV, 30, 1884 (C. A. Hart), in the Illinois State Natural
History Survey collection; Indiana, in my collection; ♀, Warren
Woods, Berrien County, Michigan, VII, 1, 1919 (R. F. Hussey),
in Hussey's collection; ♂, Alma College, Michigan, in Drake's
collection.

This form is closely related to *duzevi*, with which it has been confused in collections; it is to be distinguished by the thicker antennae, pronotal structure and color, and the scutellar characters.

15. *Aradus* (*Aradus*) *apicalis* Van Duzee (Plate II, fig. 15.)

1920. *Aradus apicalis* Van Duzee, Proc. California Acad. Sci., (4), ix, p. 331.

Distribution.—CALIFORNIA: Fallen Leaf Lake, Eldorado County, VI, 25, 1915 (E. P. Van Duzee); Millwood, Fresno County; Lake Tahoe, VI, 10, 1891; Summerdale, VI, 12, 1906 (H. E. Burke).

Description.—Very dark brown; base of hemielytra in large part except lateral margin and clavus, apex of scutellum, narrow posterior margins of connexival segments, and inner margins of genital lobes, yellowish; veins of membrane but slightly marked with white; rostrum and legs pale, the femora and tibiae with a broad, indefinite darker band at middle; ventral surface of abdomen reddish brown on disc.

Head nearly as broad as long, slightly longer than pronotum (30 to 27); tylus slightly enlarged ventrally at middle; impressions of vertex elongate, parallel; preocular tubercles well developed; antenniferous spines very stout, divergent, without lateral tooth; postocular tubercles low, rounded; antennae (fig. 15c) moderately robust, as long as head and pronotum together, the first segment reaching middle of tylus, the second slightly longer than distance between eyes (21 to 19); rostrum scarcely reaching middle of mesosternum. Pronotum (fig. 15d) moderately flat, the lateral margins finely and irregularly granulate, strongly reflexed; carinae very strongly elevated. Scutellum much longer than pronotum (37 to 27), elongate, triangular; sides very strongly elevated; apex narrowly rounded; basal fourth sharply elevated. Hemielytra (♂) extending to base of genital lobes, (♀) just beyond base of dorsal genital segment; narrowed from base to apex exposing disc of abdomen at sides; corium not quite reaching apex of fourth connexival segment; exocorium strongly expanded at base; the mesocorium with one, the endocorium without distinct transverse veins; membrane narrow, its sides parallel, rounded at apex, with few cross-veins. Abdomen oval, somewhat broader in the female, the lateral margins entire.

♂ (fig. 15b). Fifth ventral segment about as long as sixth; genital segment rather short and moderately convex. Length, 5.7 mm.

♀ (fig. 15a). Posterior margin of dorsal genital segment very slightly sinuate. Length, 6.5 mm.

Type specimen (Fallen Leaf Lake, California), No. 679, California Academy of Sciences.

This rare species, described from a single specimen, is most closely related to *duzei*, from which it differs in pronotal and especially genitalic structure. A glance at the genital lobes is sufficient to separate it from allied species. As noted above, Heidemann confused this form with *duzei*.

16. *Aradus (Aradus) curticolis* Bergroth (Plate II, fig. 16.)

1913. *Aradus curticolis* Bergroth, Can. Ent., XLV, p. 2.

Distribution.—NORTH CAROLINA: Southern Pines (A. H. Manee). GEORGIA: Marietta, HI, 5, 1911 (J. C. Bradley).

Description.—Black; finely granulate, the surface somewhat shining; third antennal segment yellowish white, except at extreme base; membrane brown; front and middle tibiae paler at middle.

Head as long as broad, much longer than pronotum (28 to 19); tylus short, broad, slightly expanded apically; impressions of vertex broad, shallow, slightly divergent anteriorly; preocular tubercles obsolescent; antenniferous spines slender, slightly divergent, without lateral tooth; postocular tubercles absent; eyes unusually prominent, substylated, directed a little upward; antennae (fig. 16c) moderately slender, as long as head and pronotum together, the first segment extending beyond middle of tylus, the second in length equal to width of head including one eye; rostrum reaching base of prosternum. Pronotum (fig. 16d) rather flat, the lateral margins entire, slightly reflexed; carinae moderately elevated. Scutellum (fig. 16d) much longer than pronotum (28 to 19), disc with slight rounded elevation extending from near base to middle, sides very slightly raised.

Macropterous form, ♂ (*sec.* Bergroth).—Hemelytra reaching apical lobes of abdomen, roundly dilated and reflected near base, exocorium and endocorium with some transverse ridges, mesocorium with a single oblique transverse ridge behind the middle. Abdomen three times broader than the membrane, apical angles of fifth segment very slightly obtusely prominent, male genital lobes obliquely slightly rounded at apex, meeting interiorly. Length, 5.8 mm.

Brachypterous form, ♀. Pronotum very flat posteriorly. Hemelytra (fig. 16d) extending well beyond apex of scutellum, almost to middle of third abdominal segment, veins distinct, membrane much reduced. Abdomen almost circular, broader than long behind scutellum (75 to 68). Genital structure (fig. 16a) very characteristic; posterior margin of dorsal genital segment almost straight. Length, 6 mm.

Type specimen (Southern Pines, North Carolina) in De la Torre-Bueno's collection.

This rare species is well distinguished by head structure, antennal coloration, short pronotum, broad abdomen in both sexes, and female genitalic traits. It is one of the few in this group which are polymorphic with respect to wing development.

17. *Aradus (Aradus) depictus* Van Duzee (Plate II, fig. 17.)

1917. *Aradus depictus* Van Duzee, Proc. California Acad. Sci. (4), VII, p. 25.

Distribution.—BRITISH COLUMBIA: North Bend, VI, 6 (H. G. Hubbard); Victoria. OREGON: Portland, V, 22 (H. G. Hubbard). CALIFORNIA: Berkeley, X, 16, 1919 (E. C. Van Dyke); Bryson, Monterey County, IV,

16, 1917 (E. P. Van Duzee); Claremont (Metz); Lagunitas, Marin County, IV, 7, 1907 (E. C. Van Dyke); Niles Canyon, V, 23, 1917 (W. M. Giffard); Oakland, IV, 16, 1911 (E. C. Van Dyke); San Leandro, VIII, 15, 1920 (E. P. Van Duzee); Santa Barbara.

Description.—Light to dark reddish brown, distinctly variegated; third antennal segment bright yellow except at base; head with pale transverse mark at base; expanded margins of pronotum with a pale, hyaline spot anteriorly; basal margin of pronotum, ends of carinae, and two anterior discal tubercles, pale; corium yellowish, with fine, irregular, dark brown markings, extreme apex black; membrane pale brown, with white reticulation; scutellum dark, the raised margins yellow at middle; edge of abdomen narrowly dark brown, posterior margins of connexival segments and inner margins of genital lobes pale, a quadrate black spot in inner anterior corner of connexival segments; second segment of rostrum, coxae, trochanters, subapical ring of femora, and basal and apical rings of tibiae, yellowish; ventral surface conspicuously variegated.

Head as long as broad, longer than pronotum (27 to 21); tylus rather short, sides parallel; impressions of vertex rather broad, distinct, slightly divergent; preocular tubercles very well developed, acute; antenniferous spines slender, divergent, with a very distinct lateral tooth which varies from obtuse to acute; postocular tubercles low, rounded; antennae (fig. 17c) comparatively slender, about as long as head and pronotum together, the first segment reaching a little beyond middle of tylus, the second as long as distance between eyes; rostrum extending a little beyond base of prosternum. Pronotum (fig. 17d) moderately convex posteriorly, the lateral margins widely expanded and serrate; carinae narrow, sharply elevated, the median with a conspicuous granule before the middle. Scutellum much longer than pronotum (34 to 21), nearly triangular but with sides parallel just at base, then almost straight to acute apex, very strongly and sharply raised; disc nearly flat, with a low, transverse carina at base. Hemelytra (σ) extending to genital lobes, (φ) over base of dorsal genital segment; connexivum entirely exposed at middle; corium reaching to or beyond middle of fourth segment; exocorium moderately expanded at base, mesocorium with one, endocorium without distinct transverse veins. Abdomen ovate, a little more narrowed anteriorly in the male; margins minutely notched.

σ (fig. 17b). Fifth ventral segment about as long as sixth; genital segment short, carinate, but slightly convex. Length, 5 to 5.5 mm.

φ (fig. 17a). Posterior margin of dorsal genital segment shallowly emarginate at middle. Length, 6 to 6.5 mm.

Type specimens (Niles Canyon and Claremont, California), No. 329, California Academy of Sciences and in Van Duzee's collection.

This is one of the most brightly marked of the American species and is well distinguished in most respects, not being closely

related to any other. It may be placed here, near the end of the *ornatus* group, as transitional in antennal structure. Van Duzee¹³ notes certain differences in coloration and in antennal and pronotal structure exhibited by the two specimens originally described, and treats them as sexual characteristics, but study of a long series received from Dr. H. H. Knight indicates that these differences are not sexual but due rather to individual variation, which, in this species, is unusually great. During the past summer Van Duzee has found *depictus* again at San Leandro, near Oakland, California, and he sends me the following notes on its habits: "As found here this species seems to occur only under the loose bark of live oak stumps and logs and the dry summer season seems to be both the time of aestivation and of development from larval to adult condition. All found were hiding in depressions or crevices of the bark. Apparently they mature and then lie almost dormant until the fall rains."

18. *Aradus (Aradus) concinnus* Bergroth (Plate II, fig. 18.)

1892. *Aradus concinnus* Bergroth, Proc. Ent. Soc. Washington, 11, p. 337.

1906. *Aradus concinnus* Bergroth, Can. Ent., xxxviii, p. 198 (*Pictosoma*).

Distribution.—CALIFORNIA: Los Angeles County (D. W. Coquillett); Palm Springs, II, 10, 1897 (H. G. Hubbard); "Southern California" (Morrison).

Description.—Brown, variegated with pale, reddish, and dark brown markings; spines and tubercles of head, first antennal segment, submedian and apical rings of second, and apical three-fourths of third, yellowish, fourth dark brown; expanded margins of pronotum with a large, ovate, yellowish translucent spot anteriorly; scutellum brown, the disc reddish yellow toward apex, the margins yellow at middle then narrowly black to apex; corium yellowish white, dark brown at apex and variably so along principal veins and between some of the transverse veins; membrane white, with more or less extensive brown maculation; connexivum reddish, each segment with a dark spot at inner basal angle and a narrow dark line along lateral margin which does not quite reach apex; inner margin of genital lobes pale; legs yellowish, femora biannulate with brown, tibiae annulate before apex; ventral surface of thorax dark brown, of abdomen pale with dark mottling.

Head slightly longer than broad (25 to 24), longer than pronotum (25 to 20); tylus of moderate length, strongly compressed; impressions of vertex deep, divergent anteriorly, whole vertex sunken; preocular tubercles very large, acute; postocular moderately developed; an extra tubercle between

¹³ Proc. Cal. Acad. Sci., (4), VII, p. 254, 1917.

preocular and postocular; antenniferous spines strong, acute, divergent, with distinct lateral tooth; antennae (fig. 18c) moderately stout, about as long as head and pronotum together, the first segment reaching scarcely to middle of tylus, the second equal in length to distance between eyes; rostrum extending over apical one-third of mesosternum, sometimes to middle. Pronotum (fig. 18d) moderately convex posteriorly, lateral margins strongly expanded, slightly reflexed, the explanate portion not reaching anterior angles; carinae coarsely granular, strongly elevated posteriorly. Scutellum longer than pronotum (29 to 20), broad, sides nearly parallel to middle, then straight to acute apex, strongly and sharply elevated, disc flat, transversely elevated at base. Hemelytra (♂) extending to genital lobes, rather strongly narrowed posteriorly, exposing disc of abdomen at sides, corium almost to apex of fourth; (♀) reaching about to middle of dorsal genital segment, similarly narrowed, corium to middle of fourth; basal expansion of exocorium moderate, evenly rounded, denticulate, slightly reflexed; mesocorium with one, endocorium without distinct transverse veins.

♂ (fig. 18b). Fifth ventral segment slightly shorter than sixth; genital segment short, moderately convex; abdomen ovate, broadest behind middle, margins entire. Length, 4 to 5 mm.

♀ (fig. 18a). Posterior margin of dorsal genital segment usually broadly rounded, sometimes nearly straight, or slightly emarginate at middle; abdomen very broad, almost circular, lateral margins entire. Length, 5 to 6 mm.

Type specimen (South California) in Stockholm Museum.

Since Hubbard found this species in large numbers at Palm Springs, California, it has very seldom been taken. It is closely related to *depictus*, from which it is readily distinguished by the shape of the scutellum; it differs from all others in the coloration of the antennae. Bergroth¹⁴, in describing the female, places the species in Laporte's group *Piestosoma*, which is typified by the European *depressus* Fabricius, because of the presence of an angulated carina which the fifth ventral segment is said to bear. This carina is a very striking feature in *depressus*, but in *concinus* it is no more strongly developed than in *fuscomaculatus*, *duzei*, *apicalis*, or *depictus*, and is, in fact, scarcely noticeable. The anteriorly lobed pronotal margins, genital peculiarities, and short second antennal segment of *depressus* are not seen in *concinus* and hence I do not think that the two can be placed in the same group. If this view is correct the subgenus *Piestosoma* of Van Duzee's Catalogue¹⁵ is to be removed from our list.

¹⁴ Canad. Entom., xxxviii, p. 198, 1906.

¹⁵ Cat. Hemip., p. 135, 1917.

19. *Aradus (Aradus) proboscideus* Walker (Plate II, fig. 19.)1873. *Aradus proboscideus* Walker, Cat. Hem.-Het. Brit. Mus., vii, p. 35.1903. *Aratus luteolus* Fyles, Can. Ent., xxxv, p. 75.1904. *Aradus hubbardi* Heidemann, Proc. Ent. Soc. Washington, vi, p. 232.1920. *Aradus taylora* Van Duzee, Proc. California Acad. Sci., (4), ix, p. 335.

Distribution.—NOVA SCOTIA: Boisdale, Cape Breton. NEW BRUNSWICK: Miscou Harbor, VI, 16, 1914 (C. H. Young). ONTARIO: Brantford, VII, 24, 1913 (C. A. G.); Hybla, V, 17, 1909 (H. Dawson); St. Martin's Falls. MAINE: Mount Katahdin, 4300 to 5000 ft., VIII, 19, 1902 (H. G. Barber); Orono, VI, 4, 1913 (H. M. Parshley). NEW HAMPSHIRE: Mount Washington (A. T. Slosson). MASSACHUSETTS. NEW YORK: Cranberry Lake, VII, 7, 1917 (C. J. Drake); Saranac Lake, IX. MANITOBA: Winnipeg Beach, VIII, 27, 1910 (J. B. Wallis). WYOMING: National Park, VIII, 10 (H. G. Hubbard). IDAHO: Moscow Mountain, X, 29, 1910 (J. A. Hyslop). MONTANA: Kallispell, VI, 13, to 20 (H. F. Wickham); Lo Lo. ALASKA: Ketchikan, IV, 15, 1916 (J. A. Kusche); Saldovia, VII, 21, 1899 (T. Kincaid). BRITISH COLUMBIA: Ainsworth, VII, 11, 1903 (A. N. Caudell); Bear Lake, 7000 ft., VII, 28 (R. P. Currie); Fry Creek, VII, 23, 1903 (A. N. Caudell); Glacier, X, 6 (E. A. Schwarz); Kaslo, VI, 1 (H. G. Dyar); Malahat, V, 29, 1917 (R. C. Treherne); Revelstoke, VII, 8 to 13, 1905 (J. C. Bradley); Terrace, VI to IX (Mrs. W. W. Hipplesley); Vancouver Island, VI, 4, 1898 (G. W. Taylor). WASHINGTON: Olympia (T. Kincaid). OREGON: Astoria, V, 25, 1902 (E. A. Schwarz); Portland, V, 22. CALIFORNIA: Blue Lake, Humboldt County, VI, 20 to 27, 1907 (J. C. Bradley); Fallen Leaf Lake, Eldorado County, VII, 19, 1915 (E. C. Van Dyke); Huntington Lake, Fresno County, 7000 ft., VII, 12, 1919 (E. P. Van Duzee); Santa Cruz Mountains; Sierra Nevada, summit; Siskiyou County; Tallac; Lake Tahoe, VII, 11, 1915 (C. W. Woodworth); Truckee, 5800 ft., VIII; Tuolumne Meadows, 9000 ft., VIII, 1, 1916 (C. Dury). NEVADA. UTAH: Alta, VII, 1 (Hubbard & Schwarz); Uinta National Forest, 8000 ft., VII, 8, 1917 (J. Silver). COLORADO: Argentine Road (H. F. Wickham); Custer County (Cockerell); Garland, V, 6, 1906; Georgetown, VII, 29, 1909, 10,000 to 12,000 ft. (W. J. Gerhard); Ouray (Hoff). ARIZONA: Williams, V, 30 (Barber & Schwarz). NEW MEXICO: Cloudcroft, VI, 18, 1902; Fort Wingate, VII; Las Vegas Hot Springs, VI, 5 (Barber & Schwarz).

Description.—Moderately dark to light cinnamon brown with paler markings of variable extent and distinctness; rarely almost black; apices of second and third antennal segments (sometimes half the latter) and preocular spines of head usually pale; posterior margin and lobes of pronotum more or less broadly pale; apex of scutellum usually pale; corium pale, with more or less of apical portion dark; membrane whitish hyaline to dark brown, sometimes maculated; posterior margins of connexival segments pale, at least at apical angles, the lateral margins often narrowly dark; inner margins of genital lobes pale; rostrum brown, darker toward apex; legs brown. coxae and apices of femora and tibiae pale; ventral surface of abdomen reddish brown, variably mottled and spotted.

Head longer than broad (36 to 32), much longer than pronotum (36 to 25); tylus large, the sides parallel; impressions of vertex narrow, deep, lunate, and widely separated; preocular tubercles distinct, moderately acute; antenniferous spines slender, acute, variably divergent, with small or obsolescent lateral tooth; postocular tubercles prominent, acute; antennae (fig. 19c) slender, cylindrical, almost as long as head and pronotum together; the first segment reaching not quite to middle of tylus, the second in length equal to width of head including one eye; rostrum extending almost or quite to middle of mesosternum. Pronotum (fig. 19d) rather flat, the margins little reflexed, with coarse teeth anteriorly and fine denticulation posteriorly; carinae well elevated, the lateral pair unusually long. Scutellum longer than pronotum (36 to 25), at least as long as head, sides slightly curved or moderately sinuate, moderately elevated; apex acute or narrowly rounded; disc with low rounded elevation before middle. Hemelytra (σ) extending to genital lobes, moderately narrowed, exposing connexivum, corium about to middle of fourth segment; (φ) extending almost or quite to dorsal genital segment, strongly narrowed, width at apex of corium equal to one-half width of abdomen, exposing a good deal of abdominal disc at sides, corium to or beyond apex of third; exocorium moderately expanded at base, evenly rounded, slightly reflexed; entire corium with numerous variable transverse veins; membrane narrowly rounded at apex; abdominal margin with small notches.

Brachypterous form.—Pronotum very little modified, narrower but just as long, sides nearly straight, oblique, width greatest a little farther posteriorly. Hemelytra extending to apex of second abdominal segment at middle; corium normally broad at base, much reduced apically, the veins distinct; membrane very short, not extending beyond apex of corium (φ , Bergroth's collection).

σ (fig. 19b). Fifth ventral segment slightly shorter than sixth; genital segment short, strongly convex, the lobes short; abdomen broadly oval, rounded posteriorly. Length, 6 to 6.9 mm.

φ (fig. 19a). Length of dorsal genital segment more than one-half breadth (18 to 30); anterior margin almost or quite evenly curved, semicircular; posterior margin curved, truncate at middle; abdomen large, oval, rather pointed posteriorly, much less than one-half broader than pronotum (80 to 60). Length, 7 to 9.7 mm.

Type specimen, φ , (St. Martin's Falls, Albany River, Hudson's Bay) in the British Museum.

This species, as understood here, is one of the most variable both in color and in details of structure; it is to be recognized by the antennal and genitalic structure, and by the pronotal characteristics, *i. e.*, the flat surface, and the oblique, usually straight, antero-lateral margins, with coarse teeth. In all but the darkest forms the pale areas situated posteriorly on the pronotum

and the vittae of the connexivum are characteristic. In the type series of Heidemann's *hubbardi* we find a good example of this unusual variability; the male type specimen has the scutellum acute and concolorous at apex, the sides slightly arcuate, while in the female the apex is narrowly rounded and pale, the sides sinuate. These differences are not sexual, and numerous intergrading conditions are to be met with in a series of specimens. As often happens in the case of variable species, a number of observers have described *proboscideus* under various names, resulting in the synonymy given above, although the variability is not great enough to have caused the confusion, had Walker's work been understood by American students. Van Duzee's *taylori*¹⁶ is founded on an example of the dark form common in British Columbia, which I do not consider worthy of a varietal name; the unfortunate comparison with *acutus*, instituted in connection with the original description, may account for the author's failure to realize the true relationships of *taylori*. Mr. G. A. Moore, of Quebec, has been kind enough to make a special visit to the Rev. Mr. Fyles for the purpose of studying the type of *luteolus*. Provided with specimens and a copy of my description he made an extremely careful examination and reported as follows: "I have no hesitancy in saying that it (Fyles' type) agrees with both specimen and description"; and he added extended notes on the detailed characters, bearing out the truth of this assertion. Through the kind offices of Mr. G. C. Champion I have received a full description and drawings of the type specimen of *proboscideus* Walker, prepared with the greatest attention to detail by Mr. K. G. Blair, of the British Museum (and an artist). From this information it was quite evident to me that Heidemann had described the same species under the name *hubbardi*, and upon my sending a typical example of the latter with my description, Mr. Blair wrote: "On comparison I think there can be no doubt that *A. proboscideus* Walk. and *A. hubbardi* Heid. are identical." Careful notes were added in this case also, and at the bottom of the sheet bearing my description, "In my opinion the two are certainly synonymous." Walker's original description is quite inadequate, and misstates the sex of the type; while that of Fyles, as might be expected of a lepidopterist,

¹⁶ Proc. Cal. Acad. Sci., (4), IX, p. 335, 1920.

is excellent in the matter of color but totally lacking in statements regarding the important structural features.

20. *Aradus (Aradus) basalis* sp. nov. (Plate II, fig. 20.)

Description.—Grayish brown; antennae darker toward apex, first segment and apices of second and third narrowly pale; corium almost entirely dull yellowish, except apical third, clavus pale at base; membrane light brown with darker shadings, a pale spot just behind scutellum; posterior margins of connexival segments narrowly dull yellowish; inner margins of genital lobes rather broadly pale; rostrum darker toward apex; legs light brown, the tibiae pale at apex; ventral surface rather dark brown, with indefinite paler areas.

Structure similar to that of the preceding, except as follows: Head more finely and evenly granulate; impressions of vertex a little longer, less curved and less widely separated; antenniferous spines slightly divergent, the lateral tooth obsolescent; postocular tubercles prominent, rounded; antennae (fig. 20c) slightly longer than head and pronotum together (69 to 65), the first segment extending beyond middle of tylus, the second as long as or longer than width of head including both eyes; rostrum extending but slightly beyond base of prosternum. Pronotum (fig. 20d) very flat, lateral margins very little reflexed, curved, with fine irregular denticulation; lateral carinae moderately long. Scutellum longer than pronotum (35 to 27), shorter than head (35 to 37), broadly triangular, the sides nearly straight, parallel only at extreme base, moderately elevated; discal elevation very slight; apex narrowly rounded. Hemicytra similar, but in the female of variable length, extending over basal one-third of fifth segment, or nearly to apex of sixth.

♂ (fig. 20b). Fifth ventral segment about as long as sixth; genital segment short, strongly convex, lobes moderate in length; abdomen comparatively broadly oval, widest behind middle. Length, 7 to 7.3 mm.

♀ (fig. 20a). Anterior margin of dorsal genital segment nearly or quite straight at middle, rather angulate laterally; posterior margin distinctly curved, truncate at middle; lobes shorter, as viewed from above, than in preceding; abdomen broadly oval, more than one-half broader than pronotum (95-60). Length, 8 to 8.3 mm.

Holotype.—♀; Temple, New Hampshire, 1900 feet, V, 26, 1900 (F. Blanchard), No. 12034, Museum of Comparative Zoology, Cambridge.

Allotype.—♂, Mount Katahdin, Maine, VIII, 9, 1902 (H. G. Barber), in my collection.

Paratypes.—♂, data of allotype, in Barber's collection; two females, data of holotype, in Academy of Natural Sciences of Philadelphia, and in my collection; ♀, Mount Washington, New Hampshire (Mrs. A. T. Slosson), in Mrs. Slosson's collection;

♀, Holden, Maine, VI, 20, 1902 (F. A. Eddy), in my collection;
♀, Maine (H. T. Fernald), in the Uhler collection, United States
National Museum, No. 24073; ♂, Saranac Lake, New York, IX
(W. T. Davis), in Davis' collection.

This species is most closely related to *proboscideus*, from which
it may be distinguished by the broader form, smaller female
genital lobes, as viewed from above, longer second antennal
segment, etc., as detailed in the table of species. Type specimens
have been compared with types of *proboscideus* Walker and *lute-
olus* Fyles by Messrs. Blair and Moore respectively, and pro-
nounced distinct.

21. *Aradus* (*Aradus*) *furvus* sp. nov. (Plate III, fig. 21.)

Description.—Dark brown, with pale markings variable in extent and
intensity; extreme apices of second and third antennal segments pale; pro-
notum more or less yellowish postero-laterally; basal expansions and veins
of corium variably pale; membrane smoky brown, basal spot and veins white;
connexivum vaguely marked with dark and light spots, but without distinct
vittae; inner margins of genital lobes very narrowly pale; legs, rostrum, and
ventral surface nearly uniform brown.

Structure as in *proboscideus*, except as follows: Head a little longer than
pronotum (32 to 28); tylus slightly bulbous; antenniferous spines very
small and slender, shorter than the tubercles which bear them, slightly diver-
gent, with small but distinct lateral tooth; antennae (fig. 21c) of slightly
different shape, the second segment as long as width of head including both
eyes; rostrum extending to apex of mesosternum. Pronotum (fig. 21d) with
lateral margins reflexed; earinae feebly developed. Scutellum very large,
triangular, width equal to three-fourths length, much longer than head (40
to 32) or pronotum; sides very slightly arcuate, slightly and evenly elevated;
apex narrowly rounded; disc with very low elevation before middle. Hemi-
elytra (♂) extending over base of genital lobes, corium to middle of fourth
segment; (♀) nearly to dorsal genital segment, more than one-half width
of abdomen at apex of corium, nearly covering abdominal disc; membrane
broadly rounded at apex.

♂ (fig. 21b). Fifth ventral segment distinctly longer than sixth; genital
segment small, strongly convex, lobes long; abdomen oval, the marginal
notches small. Length, 7.5 mm.

♀ (fig. 21e). Dorsal genital segment almost twice as broad as long (30
to 16), anterior margin sinuate; lobes rounded posteriorly; abdomen evenly
oval, one-half broader than pronotum (90 to 60); lateral margins almost
entire. Length, 8.5 mm.

Holotype.—♂; Williams, Arizona, V, 30 (Barber and Schwarz),
United States National Museum, No. 24074.

Allotype.—♀; same data, in my collection.

This species is readily distinguished from the darker forms of *proboscideus* and from *basalis* by the larger scutellum, and genital characters, especially the shape of the dorsal genital segment. The ventral valves in the allotype are opened, so that it is impossible to present a drawing of these parts, but there seem to be no strong peculiarities in their structure.

22. *Aradus (Aradus) consors* sp. nov. (Plate III, fig. 22.)

Description.—Grayish brown, with slight and obscure darker markings; antennae light reddish brown, second and third segments pale at apex, fourth darker; pronotum slightly paler across base; posterior margins of connexival segments and inner margins of genital lobes very obscurely pale; membrane light brown; ventral surface reddish brown.

Structure as in *proboscideus* except as follows: Antenniferous spines shorter, conical, slightly divergent; postocular tubercles prominent, rounded. Pronotum (fig. 22d) with disc more depressed anteriorly; lateral margins with teeth smaller and broader anteriorly; carinae very feebly elevated; posterior margin perfectly straight at middle. Scutellum broader, the sides nearly straight, feebly elevated, especially at base; apex broadly rounded. Hemelytra (♀) broad, not exposing disc of abdomen at sides, extending to middle of dorsal genital segment, corium over base of fourth; basal expansion of corium long, slightly reflexed; mesocorium with one, endocorium without distinct transverse veins; membrane broadly rounded at apex. Abdominal margin strongly crenate.

♂. Unknown.

♀ (fig. 22e). Posterior margin of dorsal genital segment almost evenly arcuate; lobes prominent, rounded; abdomen evenly oval, narrow, one-fourth wider than pronotum (75 to 60). Length, 7.6 mm.

Holotype.—♀; Massachusetts (S. Henshaw), Museum of Comparative Zoology, No. 12033.

This species is related to *proboscideus*, having the same head and antennal structure, but is readily distinguished by color, pronotal structure, longer hemelytra, crenate abdomen, and more prominent genital lobes. The genital plates seem to be similar in form to those of allied species and, being opened, cannot be drawn in a position suitable for comparison.

23. *Aradus (Aradus) persimilis* Van Duzee (Plate III, fig. 23.)

1916. *Aradus persimilis* Van Duzee, Univ. of Calif. Pubs., Tech. Bulls., 1, p. 232.

Distribution.—BRITISH COLUMBIA: Terrace, VI to IX (Mrs. W. W. Hippisley). WASHINGTON: Olympia; Paradise Park, Mount Rainier, 6000 ft., VII, 15 to 31, 1905 (E. C. Van Dyke). MONTANA: Anaconda, VIII, 24,

1908. COLORADO. CALIFORNIA: Glen Alpine Creek, Fallen Leaf Lake, Eldorado County, VI, 30, 1915 (E. C. Van Dyke); Felton, Santa Cruz Mountains, V, 20, 1907 (J. C. Bradley); Sierra Nevada, summit; Soda Springs, VIII, 8, 1906 (H. E. Burke).

Description.—Cinnamon brown, with extensive paler and darker areas; antennae darker toward apex; pronotum dark on anterior lobe except carinae; postero-lateral areas more or less broadly pale, as a rule; basal expansion of corium and sometimes the veins, apex of scutellum and usually margins toward base, posterior angles of connexival segments and sometimes their posterior margins, and inner margins of genital lobes, pale yellowish; membrane more or less distinctly maculated, the veins white; legs and ventral surface rather dark, with variable indefinite pale areas.

Structure similar to that of *proboscideus*, except as follows: Head but slightly longer than pronotum (32 to 29); antennae (fig. 23e) as long as head and pronotum together, length of the second segment almost equal to head width including both eyes, rather more distinctly enlarged at apex; rostrum extending beyond middle of mesosternum. Pronotum (fig. 23d) longer, the antero-lateral margins less strongly oblique and with coarser and more irregular teeth; disc anteriorly very strongly convex, with a narrow depression between median carinae; intermediate carinae extending a little farther forward, the lateral pair shorter. Scutellum obcordate, broadly rounded at apex, sides generally distinctly sinuate. Basal expansions of corium elongate, not evenly rounded, strongly reflexed.

♂ (fig. 23b). Fifth ventral segment distinctly shorter than sixth (10 to 13); genital segment moderately convex, very short, the lobes short, with rounded apical margins; abdomen broadly oval, sides rather strongly crenate. Length, 6.4 to 6.6 mm.

♀ (fig. 23a). Dorsal genital segment one-half as long as broad; anterior margin less than a semicircle; posterior margin slightly curved, truncate at middle; abdomen narrowly oval, pointed posteriorly, the margins almost entire. Length, 7.3 to 7.5 mm.

Type specimens (Glen Alpine Creek, Fallen Leaf Lake, California) in California Academy of Sciences and Van Duzee's collections.

This form is distinguished by the non-annulate antennae, anteriorly elevated pronotum, and the male and female genitalic traits. With the three preceding species it is best described by comparison with *proboscideus*, to avoid the repetition of identical statements; the five are closely related but sufficiently distinct species and can be recognized without difficulty by the criteria employed in the table of species.

24. *Aradus (Aradus) medioximus* sp. nov. (Plate III, fig. 24.)

Description.—Pale reddish or cinnamon brown, with some darker shadings on pronotal disc, scutellum, and veins of corium; antennae darker toward apex, the second and third segments narrowly pale at tip; apical angles of connexival segments obscurely pale, lateral margin with an obscure dark line; disc of abdomen pale reddish; ventral surface pale reddish brown, thoracic sterna darker; legs reddish, pale at joints.

Head as long as broad, equal in length to pronotum; tylus rather large, thick, the sides parallel; vertex elevated, coarsely granulated; impressions of vertex narrow, widely separated, slightly divergent anteriorly, connected posteriorly; preocular tubercles large; antenniferous spines rather small, moderately divergent, the lateral tooth very distinct; antennae (fig. 24c) slender, cylindrical, shorter than head and pronotum together (62 to 72), the first segment extending not quite to middle of tylus, length of second equal to width of head including one eye; rostrum extending somewhat beyond middle of mesosternum. Pronotum (fig. 24d) strongly biconvex, the anterior lobe well elevated, the transverse depression sharply marked; sides moderately expanded and reflexed, very coarsely toothed, laminate to anterior angles; carinae distinctly raised, the intermediate pair very thick and coarsely granulate. Scutellum slightly longer than pronotum, sides slightly elevated, parallel in basal one-third, then slightly concavely arcuate to rounded apex; disc depressed, with slight central elevation. Hemelytra (♀) extending nearly to apex of dorsal genital segment, strongly narrowed exposing disc of abdomen at sides, corium reaching nearly to apex of fourth segment; basal expansion of exocorium moderate, elongate; mesocorium with one, endocorium without transverse veins.

♂. Unknown.

♀ (fig. 24a). Dorsal genital segment very large, twice as broad as long; posterior margin straight, transverse; lobes as viewed from above short, broad, contiguous inwardly; abdomen broadly and evenly oval, the margins entire. Length, 8.6 mm.

Holotype.—♀; California, in my collection.

Paratypes.—♀; Vancouver Island, British Columbia, V, 21, 1897 (G. W. Taylor), in Van Duzee's collection; ♀, [unknown locality], V, 13, 1897, in H. Osborn's collection.

This species is related to *persimilis* and *vadosus*, being in some respects intermediate. From the former it is distinguished by the structure of the pronotum and of the genital lobes and from the latter by antennal and abdominal characters, etc.

25. *Aradus (Aradus) vadosus* Van Duzee (Plate III, fig. 25.)

1920. *Aradus vadosus* Van Duzee, Proc. California Acad. Sci., (1), ix, p. 334.

Distribution.—BRITISH COLUMBIA: Vancouver Island, IX, 6, 1899 (G. W. Taylor). MONTANA: Lo Lo, V, 15, 1911.

Description.—Grayish yellow, variegated with brown and tinged with red on scutellum, pronotum posteriorly, and disc of abdomen; antennae darker in apical half, the second and third segments narrowly pale at apex, the second broadly and indefinitely pale at middle; pronotum except explanate margins sometimes almost black; connexivum with a dark marginal spot at base of each segment; tergum with a series of dark spots, each shared by adjacent segments and situated mostly within connexival suture; disc of sixth abdominal and dorsal genital segments dark, the latter with a narrow, median, pale stripe; genital lobes with narrow dark margin in lateral half; hemielytra dark brown, veins of corium paler; legs yellowish with irregular dark spots, tibiae pale at apex.

Head longer than broad (40 to 34), longer than pronotum (40 to 30); tylus large, slightly bulbous; impressions of vertex narrow, parallel, close to eyes, between them two rows of pale granules diverging anteriorly; preocular tubercles very distinct; antenniferous spines slender, divergent, with distinct lateral tooth, suddenly broader at base; antennae (fig. 25e) slender, almost as long as head and pronotum together, the first segment not reaching middle of tylus, the second in length more than equal to width of head including both eyes (36 to 31); rostrum extending slightly beyond middle of mesosternum. Pronotum (fig. 25d) distinctly convex before and behind transverse depression; lateral margins slightly reflexed, strongly expanded to anterior angles, with large teeth; carinae well elevated. Scutellum longer than pronotum (40 to 30), sides slightly curved from base to rounded apex and a little elevated; basal portion of disc somewhat elevated and bearing three longitudinal carinae. Hemielytra (♂) reaching genital lobes, corium to apex of fourth at connexival suture; (♀) extending to middle of sixth abdominal segment, the corium to middle of fourth; connexivum broadly exposed; exocorium moderately expanded, the dilation elongate; mesocorium with one, endocorium without distinctly developed transverse veins.

♂ (fig. 25b). Sixth ventral segment longer than fifth, angulately emarginate posteriorly; genital segment short, strongly convex, the lobes rather short; abdomen oval, margins crenate at sutures. Length, 8.7 mm.

♀ (fig. 25a). Dorsal genital segment truncate at apex; abdomen elongate oval, margins slightly crenate at sutures. Length, 9.75 mm.

Type specimen (Vancouver Island, British Columbia) in Van Duzee's collection.

This is a rather brightly marked species, related to *debilis*, from which it is to be distinguished by the color of the antennae, shape of pronotum, and genitalic structure.

26. *Aradus (Aradus) debilis* Uhler (Plate III, fig. 26.)

1876. *Aradus debilis* Uhler, Bull. U. S. Geol. Geog. Surv., 1, p. 322.

Distribution.—BRITISH COLUMBIA: Mount McLean, VI, 19, 1917 (M. H. Ruhmann); North Bend, VI, 7; Revelstoke; Saanich District, Vancouver Island, VIII, 6, 1918 (W. Downes); Yale. WASHINGTON: Pullman, VII, 20,

1898 (C. V. Piper); Seattle. IDAHO: Moscow (R. A. Cooley). MONTANA: Kalispell, VI, 13 to 20 (H. F. Wickham). [COLORADO.] CALIFORNIA: Fallen Leaf Lake, Eldorado County, VII, 17, 1915 (E. C. Van Dyke); Huntington Lake, Fresno County, 7000 ft., VII, 12, 1919 (Mrs. E. P. VanDuzee); Lake Tahoe, VI, 10, 1891; Meyers, VII, 5; Monterey; Shasta County, V, 6, 1913 (F. W. Nunnemacher); Sierra Nevada; Truckee, 5800 ft., VIII (H. F. Wickham). ?MASSACHUSETTS: Woburn, IV, 27, 1907 (G. E. Morris).

Description.—Pale brown, with more or less reddish tinge; third antennal segment yellowish white except at base, fourth and apex of second dark; disc of pronotum, scutellum, and corium between veins variably darkened, the basal expansion of corium pale; membrane dark, more or less distinctly maculated; connexivum finely mottled, the segments dark at base; rostrum reddish brown, darker toward apex; legs reddish brown, with fine dark spots and sparse pale granules, the tibiae pale at apex and sometimes at middle; ventral surface reddish brown, finely mottled.

Head longer than broad (40 to 34), almost as long as pronotum; tylus long, moderately bulbous; impressions of vertex deep, slightly curved, widely separated, convergent posteriorly; preocular tubercles large, acute, spinose; antenniferous spines rather short, slender, slightly divergent, with distinct lateral tooth; postocular tubercles prominent, acute; antennae (fig. 26c) very slender, almost as long as head and pronotum together (85 to 88), the first segment not reaching middle of tylus, the second longer than head (49 to 43); rostrum very long, extending to or somewhat beyond anterior margin of metasternum. Pronotum (fig. 26d) with lateral margins broadly explanate, the teeth large and variable; disc strongly elevated, the transverse depression well marked; carinae distinctly elevated, the intermediate pair tuberculate anteriorly on summit of anterior discal elevation; on the posterior slope of the latter is a transverse, granulated ridge, interrupted at middle and curved forward laterally. Scutellum shorter than pronotum (40 to 45), pentagonal, the sides roundedly angulate; apex broadly rounded; discal elevation angulate, highest posteriorly, continued halfway to apex in a sharply sloping carina; sides parallel and distinctly elevated toward base, lower toward apex. Hemelytra (σ^7) rather broad, covering abdominal disc, reaching genital lobes, corium beyond middle of fourth segment; (ρ) exposing a little of abdominal disc at sides, reaching almost or quite to middle of sixth abdominal segment, corium almost or quite to apex of fourth; basal expansion of exocorium moderately elongate; entire corium with numerous rather distinct transverse ridges.

σ^7 (fig. 26b). Fifth ventral segment slightly longer than sixth; genital segment short, strongly convex; abdomen oval. Length, 9 to 9.7 mm.

ρ (fig. 26a). Dorsal genital segment twice as broad as long, its anterior margin sharply arcuate at sides, straight across middle; posterior margin strongly arcuate as a whole, straight for a short distance at middle; abdomen oval, strongly narrowed and produced posteriorly. Length, 8.4 to 11.4 mm.

Type specimen (Vancouver Island, British Columbia) in the Uhler collection, United States National Museum, No. 24077, lectotype.

This is a large and rare species, distinguishable without difficulty by the color and structure of the antennae, as well as by pronotal and genitalic characters. It is most distinctly a western species and I feel certain that the Massachusetts example, doubtfully recorded above, has been mislabeled. In one of her Mt. Washington lists Mrs. Slosson¹⁸ records *debilis*, but the specimen proves on examination to have been misidentified.

27. *Aradus (Aradus) cineticornis* Bergroth (Plate III, fig. 27.)

1906. *Aradus cineticornis* Bergroth, Can. Ent., xxxviii, p. 198.

Distribution.—ALABAMA (C. F. Baker).

Description.—Blackish brown; second antennal segment with sparse yellow dots, third whitish yellow except in basal third; lateral and basal portions of pronotum yellow, the median carinae posteriorly either black or yellow; apical half of scutellum, sometimes only at sides, pale brown, the extreme apex black; corium, connexivum, and ventral surface mottled with yellow; apical angles and more or less of apical margins of connexival segments yellowish; legs dark, with yellow dots, trochanters and apices of tibiae pale; membrane grayish, vaguely maculated.

Head as long as broad, a little longer than pronotum (25 to 23); tylus rather short, sides parallel; impressions of vertex deep, widely separated, slightly divergent anteriorly, connected posteriorly; vertex with two parallel rows of coarse granules; preocular tubercles distinct, rather acute; eyes prominent, substylated; antenniferous spines very acute, conical, moderately divergent, with distinct lateral tooth; postocular tubercles distinct, acute or obtuse; antennae (fig. 27e) short and slender, not as long as head and pronotum together (40 to 48), the first segment reaching about to middle of tylus, length of second a little less than width of head including one eye (19 to 21); rostrum extending about to middle of mesosternum. Pronotum (fig. 27d) with lateral margins rather broadly explanate but scarcely reflexed, variably crenulate and with a few remote, blunt teeth; disc with a decided transverse elevation anteriorly, on which the intermediate carinae terminate each in a tubercle; carinae well elevated. Scutellum slightly longer than pronotum (26 to 23), broad, sides slightly raised, sinuate, parallel in basal third, straight toward the very broad apex; basal half a little elevated, with a narrow, median, tuberculiform extension. Hemelytra (♂) rather strongly narrowed, exposing disc of abdomen at sides, reaching genital lobes, corium to apex of fourth segment; (♀) similarly narrowed, reaching about to middle of sixth segment, corium about to middle of fourth; basal expansion of exocorium rather narrow; mesocorium with two, endocorium without distinct transverse veins. Abdomen broadly oval; the lateral margins with distinct subangular prominence before apex of each segment.

♂ (fig. 27b). Fifth ventral segment shorter than sixth (10 to 13); genital segment short, strongly convex, the lobes very short. Length, 5.8 to 6 mm.

¹⁸ Ent. News, vi, p. 321, (1895).

♀ (fig. 27a). Dorsal genital segment much wider than long (15 to 10), its posterior margin slightly curved, straight just at middle. Length, 6.5 to 6.7 mm.

Type specimens (Alabama) in Bergroth's collection.

This species is distinct in most of its characters, especially in color, shape of abdomen (broad in both sexes), and genitalic structure, while exhibiting somewhat remote relationships with *proboscideus* and *similis*, as Bergroth remarks. It appears to have been found on one occasion only, as the seven or eight specimens existing in collections bear identical data.

28. *Aradus (Aradus) parvicornis* sp. nov. (Plate III, fig. 28.)

Description.—Dark brown; posterior portion of pronotum between carinae, apical half of scutellum, and veins of inner half of corium, dull reddish yellow; membrane whitish hyaline; first antennal segment and apices of second and third inconspicuously pale; connexival segments reddish brown, each outlined on three sides with a strongly elevated, dark, granular ridge, the extreme apical angles dull yellowish; rostrum brown, paler toward base; legs brown, trochanters and apices of tibiae pale; ventral surface reddish brown with rather conspicuous paler markings.

Head a little longer than broad (26 to 24), much longer than pronotum (26 to 20); tylus rather large, somewhat bulbous; impressions of vertex narrow, deep, parallel, close to eyes; preocular tubercles distinct, moderately acute; antenniferous spines very short, conical, moderately divergent, without lateral tooth; postocular tubercles distinct, obtuse; antennae (fig. 28c) extremely small, scarcely longer than head alone (fourth segment missing, probably as long as third), the first segment scarcely reaching basal third of tylus, length of second less than distance between eyes (12 to 16); rostrum extending not quite to base of prosternum. Pronotum (fig. 28d) strongly convex, with sharp transverse depression; lateral margins narrowly explanate, not reflexed, with coarse, irregular, long, blunt teeth; carinae well elevated. Scutellum (fig. 28d) broad, slightly shorter than head (25 to 26); basal elevation most pronounced at angles, with a narrow median longitudinal carina; sides moderately elevated. Hemicytra (♀) moderately narrowed, exposing disc of abdomen slightly at sides, extending a little beyond base of dorsal genital segment; corium to base of fourth; basal expansion of exocorium very moderate, elongate; mesocorium and endocorium with numerous moderately distinct cross-veins.

♂. Unknown.

♀ (fig. 28a). Posterior margin of dorsal genital segment very slightly emarginate in middle third, straight and slightly oblique each side; genital lobes, as seen from above, extremely short, their greatest length (near inner margin) about equal to one-fourth transverse width; abdomen oval, about one-third broader than pronotum (60 to 46), sides evenly rounded, without crenulation. Length, 5.8 mm.

Holotype.—♀; Vermejo, New Mexico, in my collection.

Paratype.—♀; Hideaway, Oregon, VII, 27, 1913 (W. D. Edmonston), United States National Museum, No. 24075.

A small and very rare species, related to *cincticornis*, but readily distinguished by the small antennae, broad scutellum, evenly rounded abdominal margins, and genitalic structure. The paratype lacks the antennae.

29. *Aradus* (*Aradus*) *opertaneus* sp. nov. (Plate III, fig. 29.)

Description.—Uniform dark brown; a pale mark at base of head; corium with very vague pale markings; apical angles of connexival segments indistinctly yellowish; membrane brown, with pale basal spot and more or less white along the veins.

Head longer than broad (30 to 27), much longer than pronotum (30 to 20); tylus rather long, compressed, slightly enlarged at middle; impressions of vertex, narrow, deep, parallel; preocular tubercles obtuse, scarcely elevated; antenniferous spines moderately slender and divergent, the lateral tooth small but distinct; postocular tubercles prominent, obtusely rounded; antennae (fig. 29c) moderately slender, about as long as head and pronotum together, the first segment extending a little beyond middle of tylus, length of second equal to width of head including one eye; rostrum reaching middle of prosternum, the prosternal ridges strongly elevated. Pronotum (fig. 29d) slightly convex, transverse depression moderately developed; sides slightly expanded and scarcely reflexed, with moderately coarse teeth; earinae rather feebly elevated. Scutellum longer than pronotum (30 to 20), broadly triangular; sides and disc very little elevated; apex narrowly rounded. Hemelytra (♀) strongly narrowed, exposing disc of abdomen at sides, extending at most to base of dorsal genital segment; corium about to apex of third; basal expansion of exocorium strong, evenly rounded; mesocorium with one, endocorium without distinct transverse veins.

♂. Unknown.

♀ (fig. 29a). Dorsal genital segment about twice as broad as long, posterior margin almost straight; lobes evenly rounded, finely denticulate; abdomen comparatively large, much broader than pronotum (70 to 47), elongate oval, rather pointed posteriorly; lateral margins almost entire, the notches slight. Length, 6.5 to 7.1 mm.

Holotype.—♀; Cass County, Minnesota, VI, 25, 1893 (O. W. Oestlund), in my collection.

Paratypes.—Females; same data, in University of Minnesota collection and in mine.

A species intermediate in some respects between the *proboscideus* and *similis* groups; most closely related to *similis*, from which it may be distinguished by the short rostrum, antennal and genitalic structure, and general coloration.

30. *Aradus (Aradus) similis* Say (Plate III, fig. 30.)1832. *Aradus similis* Say, *Het. Hem.*, p. 28; *Compl. Writ.*, i, p. 351.1873. *Aradus fuscicornis* Walker, *Cat. Hem.-Het. Brit. Mus.*, vii, p. 36.

Distribution.—NOVA SCOTIA: VI (Wm. T. Davis). MAINE: Cumberland County, VI, 1916 (A. Nicolay); Orono, IV, 29, 1913, VI, 4, 1913 (H. M. Parshley). NEW HAMPSHIRE: Durham, IV, 19, 1906 (C. S. Spooner). MASSACHUSETTS: Cambridge, V, 19 (Hubbard & Schwarz); Forest Hills, XI, 8, 1916 (W. M. Barrows); Springfield, X, 31, 1901 (F. Knab); Sunderland, Mt. Toby, V, 12, 1918 (H. M. Parshley); Tyngsboro, V, 6, 1900 (F. Blanchard). CONNECTICUT: Meriden, V, 8, 1911 (A. B. Champlain); Stonington, V, 1914 (I. W. Davis). NEW YORK: Chauncey, III, 31, 1918 (H. Notman); Cranberry Lake, VII, 9, 1917 (C. J. Drake); Ithaca, Staten Island, V, 10 (Wm. T. Davis); White Plains, III, 21, 1909, IV, 18, 1909 (J. R. de la Torre-Bueno); Yaphank, Long Island, V, 30, 1911 (C. E. Olsen). NEW JERSEY: Cedar Lake, X, 25, 1915 (H. G. Barber); Great Notch, V, 30, 1906 (H. G. Barber); Greenwood Lake, V, 8 (H. G. Barber); Manchester, IV, 15 (Wm. T. Davis); S. Amboy, III, 26, 1916 (F. M. Schott). PENNSYLVANIA: North Mountain, IX, 1, 1897 (C. W. Johnson); Wilmerding (M. Wirtner). DISTRICT OF COLUMBIA: Brightwood, V, 5, 1901 (O. Heidemann); Brookland, XI, 26, 1914 (L. O. Jackson); Washington, II, 21, 1897 (O. Heidemann). MARYLAND: Edgewood, XII, 8, 1918 (H. Dietrich). VIRGINIA: Virginia Beach, X, 7, 1901 (W. Beutenmuller). NORTH CAROLINA: Andrews, V, 1908 (F. Sherman); Goldsboro, V, 2, 1901 (F. Sherman); Sunburst, V, 1912 (F. Sherman); Tryon, 1903 (W. F. Fiske). GEORGIA. FLORIDA: Biscayne Bay (A. T. Slosson); Gulfport, I, 6, 1915 (A. G. Reynolds). OHIO: Cincinnati, V, 17, 1919 (C. Dury); Columbus, 3, V, 1901. MICHIGAN: Allegan, VIII, 18, 1913 (F. Psota). INDIANA: Bluffton, V, 4, 1902 (C. C. Dean); Wyandotte, V, 26, 1904. ILLINOIS: Chicago; McHenry, VIII, 23, 1881 (C. A. Hart); Palos Park, V, 8, 1904 (A. B. Wolcott); Urbana, X, 30, 1891 (McElfresh). WISCONSIN: Madison, IV, 2, 1907 (C. B. Hardenburg). IOWA: Ames, (H. Osborn). MISSOURI. KANSAS: Topeka. MISSISSIPPI: Agricultural College, IV, 11, 1915. TEXAS: Plano, X (E. S. Tucker); Willis.

Description.—Pale to blackish brown; third antennal segment more or less distinctly pale except at base, second sometimes with vague pale markings; disc and basal expansion of corium variably pale, the membrane whitish hyaline, sometimes with vague maculation; apical angles and sometimes apical margins of connexival segments, and inner margins of genital lobes, dull yellowish; apices of tibiae and sometimes of femora pale. All light markings vary toward obsolescence.

Head as long as broad, much longer than pronotum (30 to 20); tylus moderate in size, sides nearly parallel; impressions of vertex deep, straight, slightly divergent anteriorly; preocular tubercles minute; antenniferous spines rather large, moderately divergent, the lateral tooth minute; postocular tubercles prominent, obtuse; antennae (fig. 30c) moderately slender, almost as long as head and pronotum together (17 to 50), the first segment

reaching middle of tylus, slightly variable in length and thickness, the second in length equal to or very slightly exceeding width of head between eyes; rostrum extending not quite to base of prosternum. Pronotum (fig. 30d) moderately convex, the transverse depression distinct; width slightly more or slightly less than width of hemielytra at widest point; lateral margins with irregular coarse teeth, the expanded portion narrowed anteriorly and posteriorly; carinae well elevated. Scutellum much longer than pronotum (31 to 20), elongate, pentagonal, sides angulate, parallel in basal third, straight to rather narrow apex, or sometimes more or less evenly arcuate, moderately elevated; disc slightly elevated before middle, with two shallow depressions at base. Hemielytra strongly narrowed, exposing disc of abdomen at sides; (♂) extending to genital lobes, corium to middle of fourth segment; (♀) about to middle of sixth, corium to apex of third; exocorium moderately and somewhat variably expanded at base; mesocorium with one, endocorium without distinct transverse veins, but with numerous fine transverse ridges more or less developed; abdomen broadly oval, sides distinctly notched.

♂ (fig. 30b). Fifth ventral segment about as long as sixth; genital segment rather short, strongly convex, carinate. Length, 5 to 7 mm.

♀ (fig. 30a). Dorsal genital segment twice as wide as long, the posterior margin arcuate, truncate at middle. Length, 6 to 8.5 mm.

Type specimens (United States) lost.

This species, commonly found about the shelf-fungus of birch (*Polyporus*), is very variable in color, size, and certain details of structure, but it is distinguishable by the form of the pronotum, short second antennal segment (which is of somewhat variable thickness), and usually by the antennal coloration, in addition to genitalic criteria. Mr. Blair, of the British Museum, has kindly sent for examination a specimen (Nova Scotia) from the type series of Walker's *fascicornis*; this represents a common pale brownish form with markings almost obliterated, although the third antennal segment is paler than the others. The second antennal segment is slightly longer than the distance between eyes and is rather slender. This specimen is a female, 7.7 mm. in length. Intergradations between this form, variety *centriguttatus*, and typical *similis* are of common occurrence, without relation to locality, and it is impossible to draw specific distinctions among them. It is interesting to note that Say was aware of the variability of his species, for he writes in connection with the original description: "The penultimate joint of the antennae is sometimes very dull and almost obsoletely whitish."

Aradus similis variety **centriguttatus** Bergroth

1887. *Aradus centriguttatus* Bergroth, Rev. Ent., vi, p. 246.

1892. *Aradus similis* var. *centriguttatus* Bergroth, Proc. Ent. Soc. Washington, ii, p. 332.

Distribution.—With the typical form, but rarer in the North.

Description.—Coloration uniformly dark; third antennal segment concolorous; membrane generally black with a white spot near apex of scutellum; connexival spots obsolescent or absent. Otherwise like the typical form.

Type specimens in Bergroth's and Montandon's collections, collected in Florida by Ashmead.

Bergroth¹⁹ pronounces this form, originally described as of specific rank, to be "only a variety of *similis*," and knowing this eminent author's views on naming varieties, I have no doubt that he would consider the name *centriguttatus* as a pure synonym. However, I think it useful to provide this and similar striking variations with distinctive names, and *centriguttatus* is by no means the least worthy among them. As noted above, we find intermediate forms, with lighter brown color, paler membrane, and faintly yellowish third antennal segment, leading insensibly toward the typical variety.

31. Aradus (Aradus) shermani Heidemann (Plate IV, fig. 31.)

1907. *Aradus shermani* Heidemann, Proc. Ent. Soc. Washington, viii, p. 68.

Distribution.—QUEBEC: Ottawa, VI, 13, 1913 (G. Beaulieu); ONTARIO: Ormsby Junction, County Hastings, V, 23, 1911 (J. D. Evans); Sudbury, V, 18, 1889; Toronto, VIII, 20, 1913 (C. A. G.); Trenton, VI, 6, 1903 (J. D. Evans). MAINE: Orono, V, 22, 1914. NORTH CAROLINA: Southern Pines, I, 1904 (F. Sherman). GEORGIA.

Description.—Black; membrane with a small pale spot near apex of scutellum; extreme apical angles of connexival segments very obscurely dull reddish, often not noticeably so.

Head longer than broad (37 to 32), much longer than pronotum (37 to 25); tylus rather long, sides parallel; impressions of vertex deep, nearly parallel, widely separated; base of head with distinct oblique smooth pale lines; preocular tubercles small but distinct, acute; antenniferous spines slender, acute, strongly divergent, the lateral tooth small or obsolescent; postocular tubercles prominent, acute; antennae (fig. 31c) slender, as long as head and pronotum together, the first segment not quite reaching middle of tylus, the second slightly less in length than width of head including both eyes (29 to 31) and slightly longer than the third and fourth together (28 to 25); rostrum

¹⁹ Proc. Ent. Soc. Wash., ii, p. 332, (1892), and *in litt.*

extending over anterior fourth of mesosternum. Pronotum (fig. 31d) rather flat, lateral margins not reflexed, the teeth comparatively even, but variable, often much smaller and more numerous than in the figure; carinae moderately elevated, the median pair nearly parallel in the male or moderately convergent at middle in the female. Scutellum longer than pronotum (35 to 25), triangular, sides straight or slightly curved from near base to narrow apex, slightly elevated; disc with low rounded prominence before middle, two depressions at base. Hemelytra (♂) broad, exposing scarcely more than the connexivum, reaching middle of genital lobes, corium beyond middle of fourth segment; (♀) much more narrowed toward apex, reaching to middle of sixth segment, corium to base of fourth; exocorium moderately expanded at base; entire corium with numerous more or less distinct transverse veins.

♂ (fig. 31b). Fifth ventral segment distinctly shorter than sixth, its apical margin broadly transverse and almost straight across middle; genital segment short, strongly convex, carinate; abdomen broadly oval, crenate. Length, 6.8 mm.

♀ (fig. 31a). Dorsal genital segment more than one-half as long as broad (18 to 30), the posterior margin variably emarginate at middle, straight, oblique laterally; abdomen elongate, oval, lateral margins notched. Length, 8 to 8.8 mm.

Type specimens (Southern Pines, North Carolina), No. 9866, United States National Museum; and in the Heidemann collection, Cornell University.

This species, closely related to *similis* and to *acutus*, is to be distinguished by the color, antennal structure, and genital characteristics. The pronotal teeth are usually rather small and even, but they exhibit considerable variation, with intermediates which are often asymmetrical, between the extremes. A male specimen from Greensburg, Pennsylvania, included by Heidemann in the type series, is an obscurely marked example of *acutus*, identical with another having the same data, which Heidemann placed with his *acutus* series. There are several specimens of *shermani* in collections, determined by Van Duzee as *similis* variety *centriguttatus*.

32. *Aradus (Aradus) acutus* Say (Plate IV, fig. 32.)

1832. *Aradus acutus* Say, Het. Hem., p. 28; Compl. Writ., 1, p. 351.

Distribution.—MAINE: Norway (O. O. Stover). NEW HAMPSHIRE: VIII, 1850 (Harris Coll.); Temple, V, 26, 1900 (F. Blanchard). NEW JERSEY: Anglesea, IV, 11 (H. G. Barber). DISTRICT OF COLUMBIA: Brightwood, III, 4 (O. Heidemann); Rock Creek; Washington, XII, 1, 1895 (O. Heidemann). DELAWARE: X, 1879. MARYLAND: Baltimore, V, 10 (P. R.

Uhler). PENNSYLVANIA: Greensburg (M. Wirtner); St. Vincent (M. Wirtner). VIRGINIA: Great Falls, IX, 5, 1918 (W. L. McAtee). NORTH CAROLINA: Blantyre, V, 1908 (F. Sherman); Lexington, III, 29, 1905 (F. Sherman); Raleigh, XI, 17, 1905; Southern Pines, XII, 9, 1915 (A. H. Mance); Tryon, IV, 17, 1903 (W. F. Fiske). GEORGIA: Dewitt, III, 28, 1912 (C. S. Spooner); Everett, (W. F. Fiske). ALABAMA: Mobile, I, 27, 1912 (H. P. Loding). [FLORIDA, *see*, Bergroth.] OHIO: Chillicothe, V, 21, 1901 (Swezey). INDIANA: Hessville, VI, 4, 1911 (A. B. Walcott). ILLINOIS: Cobden, IV, 28, 1882 (C. A. Hart); Devil's Neck, VI, 7, 1905 (C. A. Hart); Havana, V, 1, 1912 (C. A. Hart). MISSOURI: St. Louis, II, 24, 1876. MISSISSIPPI: Jackson, II, 3, 1879 (E. A. Schwarz). KANSAS. ARKANSAS. COLORADO: West Cliff. TEXAS: Austin (C. T. Brues); Dallas; Mt. Home, III, 26, 1906 (F. C. Pratt); Paris, II, 27, 1904 (C. T. Brues). MONTANA: Helena, VII, 21, 1907 (W. M. Mann). WASHINGTON. [CALIFORNIA, *see*, Bergroth.]

Description.—Blackish brown, the surface thickly strewn with fine whitish granules, forming a distinct pattern especially on connexivum; basal expansions of corium and some of the veins, discal spots and apical angles of connexival segments, and disc of genital lobes, dull yellowish; dorsum black, with triangular extensions along connexival suture; antennae and rostrum black; legs black, the tibiae paler, apices of femora and tibiae dull reddish yellow; ventral surface of abdomen black to reddish brown, with indefinite pale marginal markings. In very dark specimens the markings are obscure.

Head longer than wide (35 to 31), longer than pronotum (35 to 28); tylus moderate in size, sides almost parallel; impressions of vertex narrow, deep, almost parallel; preocular tubercles small; antenniferous spines slender, acute, strongly divergent, the lateral tooth scarcely developed; postocular tubercles very distinct, acute; antennae (fig. 32c) clavate, a little shorter than head and pronotum together (60 to 63), the first segment reaching middle of tylus, the second in length equal to width of head including both eyes, distinctly longer than third and fourth together (31 to 23); rostrum extending nearly to middle of mesosternum. Pronotum (fig. 32d) flat, the lateral margins irregularly crenulate, not reflexed, a few large teeth anteriorly; carinae moderately elevated. Scutellum longer than pronotum (33 to 28), sides slightly arcuate from base, sinuate toward the rounded apex, slightly elevated at middle; base slightly elevated, with three very faint longitudinal carinae. Hemelytra (σ) extending to genital lobes, corium about to middle of fourth segment; (φ) extending not quite to genital segment, corium to base of fourth; abdominal disc exposed at sides; exocorium distinctly expanded; mesocorium and endocorium usually with one distinct transverse vein.

σ (fig. 32b). Fifth ventral segment as long as sixth; abdomen oval, rounded posteriorly, the margins slightly notched. Length, 7 to 8 mm.

φ (fig. 32a). Dorsal genital segment not quite one-half as long as broad; posterior margin sinuate, truncate at middle; abdomen ovate, rather pointed posteriorly, the margins slightly notched. Length, 8 to 9.6 mm.

Type specimens (Florida and Indiana) lost.

This widely distributed and locally common form is to be recognized by the conspicuous pattern of pale granules and yellowish markings, long second antennal segment, and short first female genital segment. It was clearly characterized by Say and has been correctly identified by most students, although Heidemann in several instances determined specimens of *inornatus* as the present species, probably during the earlier years of his studies.

33. *Aradus (Aradus) inornatus* Uhler (Plate IV, fig. 33.)

1876. *Aradus inornatus* Uhler, Bull. U. S. Geol. Geog. Surv., 1, p. 323.

Distribution.—QUEBEC: Lanoraie, VI, 15, 1915, (J. I. Beaulne); Fort Coulonge, VI, 9, 1918 (E. C. Van Dyke); Ottawa, V, 25, 1914. ONTARIO: Grimsby, V, 2, 1913 (J. F. Brimley); Sudbury, 1889; Trenton, 1899 (J. D. Evans). MAINE: Orono, V, 1, 1914 (H. M. Parshley). NEW HAMPSHIRE: Claremont, VI to X; Hanover (C. M. Weed); Merrimack, V, 11, 1900 (F. Blanchard). MASSACHUSETTS. [PENNSYLVANIA, *sec.* Bergroth.] DISTRICT OF COLUMBIA: Washington, IV, 16 (O. Heidemann). MARYLAND. VIRGINIA: Great Falls, IX, 5, 1916 (H. G. Barber). NORTH CAROLINA: Raleigh, II, 17, 1906; Wilmington Beach, IV, 6, 1914 (H. G. Barber). [SOUTH CAROLINA; GEORGIA, *sec.* Bergroth.] TENNESSEE. MICHIGAN: Lake Superior (C. A. Hart). ILLINOIS. WISCONSIN: Madison, VI, 1, 1914 (A. H. A.). SOUTH DAKOTA: Hill City.

Description.—Dull light to dark brown, the connexivum paler and sometimes vaguely spotted; antennae darker toward apex; membrane uniformly brown; ventral surface of abdomen reddish brown.

Head much longer than broad (40 to 33), longer than pronotum (40 to 37); tylus rather long, slightly enlarged at middle; impressions of vertex narrow, deep, nearly parallel; preocular tubercle acute, moderate or minute in size; antenniferous spines slender, slightly divergent, the lateral tooth obsolescent; postocular tubercles large, acute; antennae (fig. 33c) moderately slender, shorter than head and pronotum together (72 to 77), the first segment reaching middle of tylus, the second longer than width of head including both eyes (40 to 33), as long as head; rostrum not reaching middle of mesosternum. Pronotum (fig. 33d) flat, the transverse depression slight, lateral margins coarsely toothed, especially anteriorly, and scarcely reflexed; carinae feebly elevated. Scutellum as long as pronotum, sides rather irregularly curved from base to apex, shape tending toward pentagonal; sides feebly and variably elevated; apex narrowly rounded; disc and basal angles feebly elevated. Hemelytra (♂) reaching genital lobes, corium to apex of fourth segment; (♀) scarcely reaching dorsal genital segment, corium to base of fourth; exocorium moderately expanded; mesocorium with one or two, endocorium without very distinct transverse veins.

♂ (fig. 33b). Fifth ventral segment slightly longer than sixth; genital segment short, strongly convex; abdomen broadly oval, crenate. Length, 8.5 mm.

♀ (fig. 33a). Dorsal genital segment twice as wide as long, the posterior margin very obtusely angulate as a whole; abdomen narrowly oval, moderately produced posteriorly, the margins slightly notched. Length, 10 mm.

Type specimen (Maryland) in the Uhler collection, United States National Museum, No. 24080, lectotype.

This species, which has often been misunderstood by students and sometimes determined as *acutus*, is not found west of the Rocky Mountains, as defined here. It is readily recognized by its uniform coloration, long and regularly enlarged second antennal segment, flattened pronotum, feeble carinae, etc., according to the criteria given in the table of species. The original series, from which Uhler drew up his description, contains two species, one of which, occurring in the Pacific Coast region, has been described by Van Duzee²⁰ as *blaisdelli*. In selecting single type specimens of Uhler's species, I have as a rule chosen the one which bears Uhler's label with the specific name, but in this case it has seemed advisable to depart from this principle in order to avoid the necessity of changing names. A Maryland example, mentioned in connection with the original description, has therefore been denominated the type of *inornatus* (although it is unfortunately somewhat imperfect). The specimen which bears Uhler's label is without definite locality and has an abnormal pronotum, but it is certainly an example of the western *blaisdelli*. I can see no useful purpose to be served in selecting this specimen, and much against such a course; Uhler did not name definite types and doubtless it is merely the first specimen, as his arrangement originally stood, which bears the label.

34. *Aradus* (*Aradus*) *blaisdelli* Van Duzee (Plate IV, fig. 34.)

1920. *Aradus blaisdelli* Van Duzee, Proc. California Acad. Sci., (4), IX, p. 333.

Distribution.—BRITISH COLUMBIA: Vernon, V, 31, 1917 (M. H. Ruhmann). WASHINGTON: Pressy's, Wenass V. (W. T.), VII, 6, 1882 (S. Henshaw). MONTANA: Bohner, V, 26, 1904; Florence, VI, 16, 1912; Lo Lo, VI, 10, 1912. NEVADA. CALIFORNIA: Huntington Lake, Fresno County, 7000 to 8000 ft., VII, 7 to 22, 1919 (E. P. Van Duzee); Lake Tahoe, VIII, 10, 1891; Mohave Desert, Holcomb Valley (Ariz.?), Oak Grove.

²⁰ Proc. Cal. Acad. Sci., (1), IX, p. 333, (1920).

Description.—Blackish brown; third antennal segment indefinitely paler, as a rule; basal expansion of corium and most of the veins pale brown; connexivum with variable yellowish brown spots, especially at apical angles of segments; basal spot and veins of membrane mostly white; legs brown, the coxae and apices of tibiae pale; edges of bucculae and plates forming rostral groove, and disc of abdomen ventrally, dull reddish or pale brown.

Structure about as in the preceding except as follows: Antennae (fig. 34c) about as long as head and pronotum together, the first segment scarcely reaching middle of tylus, the second in length more than equal to width of head including both eyes (43 to 32); rostrum reaching beyond middle of mesosternum, sometimes attaining metasternum. Pronotum (fig. 34d) with dorsal surface much more uneven, the transverse depression distinct, disc depressed on each side due to reflexion of lateral margins; sides anteriorly of variable shape, arcuate (*cf.* fig.) to nearly straight and oblique; carinae much more strongly elevated, the terminal tubercles of intermediate pair larger, surmounting the distinctly elevated anterior discal region. Scutellum slightly longer than pronotum, the sides a little more strongly elevated. Hemelytra and corium a little shorter in both sexes.

♂ (fig. 34b). Fifth ventral segment as long as sixth; abdomen broadly oval. Length, 9 mm.

♀ (fig. 34a). Dorsal genital segment less than twice as wide as long, the posterior margin strongly angulate; abdomen strongly narrowed and produced posteriorly. Length, 10.5 mm.

This species, while closely related to *inornatus*, is distinguished by characters sufficiently important to prevent its being regarded as a geographical race (see the table of species). As noted above, it was included by Uhler in his series of *inornatus*. Study of the type specimens has revealed certain minor inaccuracies in the description of this species and of others made known in the same paper (Van Duzee, 1920), especially in the statements of dimensions, which I have tried to correct, without particular comment in each case.

35. *Aradus* (*Aradus*) *hesperius* sp. nov. (Plate IV, fig. 35.)

Description.—Dark brown, the head, pronotum, scutellum, connexivum, and veins of corium thickly covered with pale grayish granules, which are usually very conspicuous; antennae sparsely sprinkled with similar granules; basal expansion of veins of corium sometimes yellowish; membrane with a distinct basal white spot, the veins more or less distinctly outlined with white; apical angle and a posterior discal spot of each connexival segment yellowish; rostrum and ventral surface of head and thorax dark brown; legs dark brown, the tibiae and femora pale at base and apex; ventral surface of abdomen light brown, often darker laterally.

Head much longer than broad (42 to 35), longer than pronotum (42 to 35); tylus long, slightly bulbous; impressions of vertex deep, moderately narrow, nearly parallel; preocular tubercles rather small, acute; antenniferous spines rather short, slender, variably divergent, the lateral tooth obsolescent; postocular tubercles large, acute; antennae (fig. 35c), rather slender, about as long as head and pronotum together, the first segment reaching not quite to middle of tylus, the second in length much more than width of head including both eyes (43 to 35), longer than head; rostrum reaching almost to metasternum. Pronotum (fig. 35d) moderately convex, the transverse depression distinct; lateral margins reflexed, with three or four large teeth anteriorly; carinae well elevated, the terminal tubercles of the intermediate pair moderately large. Scutellum pentagonal, the sides moderately sinuate beyond middle and distinctly though moderately elevated; discal elevation triradiate; base depressed; apex narrowly rounded. Hemelytra rather broad, covering disc of abdomen; (σ) reaching genital lobes, corium a little beyond middle of fourth segment; (φ) almost to genital segment, corium beyond base of fourth; basal expansion of exocorium moderate, evenly rounded; mesocorium with one distinct transverse vein, this and endocorium with several others feebly and variably developed.

σ (fig. 35b). Fifth ventral segment a little longer than sixth; apical margin of sixth slightly and broadly emarginate at middle; genital segment large, strongly convex, the lobes short; abdomen rather elongate oval, with margins notched. Length, 7.5 to 8 mm.

φ (fig. 35a). Dorsal genital segment about twice as broad as long, the anterior and posterior margins about equally curved, the latter more angulate, transverse or slightly emarginate at middle; abdomen narrowly oval, strongly produced posteriorly, with margins slightly notched. Length, 9 to 10 mm.

Holotype.— φ ; Arizona, in the Uhler collection, United States National Museum, No. 24076.

Allotype.— σ ; same data.

Paratypes.— σ and φ , same data; φ , Colorado; σ and φ , Williams, Arizona, VI, 7, V, 26 (Barber and Schwarz), United States National Museum and my collection.

Related to *inornatus* and *blaisdelli*, from which it may be distinguished by the form of the second antennal segment and of the pronotum, and by numerous details of color and structure.

36. *Aradus* (*Aradus*) *approximatus* sp. nov. (Plate IV, fig. 36.)

Description.—Uniform light grayish brown; pale granules of surface forming a pattern of variable but never great distinctness; antennae dark beyond middle of second segment; membrane brownish, with more or less distinct darker maculation, and faint pale basal spot; disc of abdomen dorsally bright red.

Similar in structure and habitus to *inornatus*, except as follows: Second antennal segment (fig. 36c) suddenly enlarged in apical third. Pronotal margins (fig. 36d) less broadly expanded and rather irregular in outline, the teeth very uneven.

♂ (fig. 36b). Fifth ventral segment slightly longer than sixth; genital segment very strongly convex, the lobes decidedly longer than in *inornatus*. Length, 8 mm.

♀. Genital structures about as in *inornatus* (cf. fig. 33a). Length, 10.5 to 11 mm.

Holotype.—♀; Agricultural College, Mississippi, IV, 14, 1915 (R. W. Harned), in my collection.

Allotype.—♂; Mount Katahdin, Maine, VIII, 26, 1902 (H. G. Barber), in Barber's collection.

Paratypes.—♂, Wyandanch, Long Island, New York, VI, 18, 1916 (F. M. Schott); ♀, Prospertown, New Jersey, in De la Torre-Bueno's collection; ♀, Thomasville, Georgia, III, 12, 1903 (Morgan Hebard), in Davis' collection; ♀, without data, in Van Duzee's collection.

This species, while closely related to *inornatus*, may be readily recognized by the strikingly different antennal structure and the pronotal characters.

37. *Aradus (Aradus) compressus* Heidemann (Plate IV, fig. 37.)

1907. *Aradus compressus* Heidemann, Proc. Ent. Soc. Washington, VIII, p. 70.

Distribution.—BRITISH COLUMBIA: Vancouver Island, IV, 3, 1898 (G. W. Taylor). WASHINGTON: Lake Cushman, Mason County, VII, 14, 1919 (F. M. Gaige); Paradise Park, Mount Rainier, 6000 ft., VII, 15, 1905 (E. C. Van Dyke); Seattle (Ulke); "W. T." OREGON: Dille.

Description.—Black, finely granulate; postero-lateral margins of pronotum, narrow posterior margins or at least apical angles of connexival segments, and inner margins of genital lobes, reddish yellow; basal expansion of corium and narrow sides of scutellum sometimes obscurely pale; rostrum and legs light, ventral surface dark reddish brown.

Head longer than broad (40 to 32), longer than pronotum (40 to 32); tylus long, strongly compressed, enlarged somewhat toward base; impressions of vertex short, broad, deep, connected posteriorly, behind each a pale, smooth, oblique line; preocular tubercles distinct, moderately acute; antenniferous spines rather stout, conical, moderately divergent, the lateral tooth obsolescent; postocular tubercles very low, rounded; eyes prominent, substylated; antennae (fig. 37c) moderately slender, almost as long as head and pronotum together (70 to 75), the first segment reaching middle of tylus, the second in length slightly more than equal to width of head including both eyes; rostrum

reaching apex of mesosternum. Pronotum (fig. 37d) moderately convex, lateral margins minutely and regularly granulate, strongly reflexed; carinae very strongly elevated; disc transversely rugulose posteriorly; posterior lobes strongly deflexed. Scutellum much longer than pronotum (50 to 32), elongate, cordate; sides strongly elevated, sinuate; apex rather broadly rounded; disc very slightly elevated before middle. Hemelytra (♂) broad, covering abdomen and extending to apex, corium to base of fifth segment; (♀) narrower, exposing connexivum, extending over genital segment, corium to middle of fourth; exocorium moderately expanded, less so in the male; entire corium with numerous rather well-defined transverse veins.

♂ (fig. 37b). Fifth ventral segment distinctly shorter than sixth; genital segment short, strongly convex, carinate, the lobes long; abdomen oblong-oval, the margins notched. Length, 8 mm.

♀ (fig. 37a). Dorsal genital segment much as in *borealis* (cf. fig. 38c); abdomen broadly oval, the margins entire anteriorly. Length, 8 to 9.5 mm.

Type specimens (Seattle, Washington, and "W. T."), United States National Museum, No. 9868, and Cornell University Collection paratype No. 250.1 (Heidemann collection).

This is a very rare species, confined to the Northwest, according to present knowledge; it is distinct in most of its characters. The form of the female genital lobes is somewhat variable, the inner margin being almost evenly rounded in some individuals.

38. *Aradus (Aradus) borealis* Heidemann (Plate IV, fig. 38.)

1909. *Aradus borealis* Heidemann, Proc. Ent. Soc. Washington, xi, p. 190, fig. 4.

Distribution.—QUEBEC: Ottawa. MAINE: Mount Katahdin, 5215 ft., VII, 19, 1902 (H. G. Barber). NEW HAMPSHIRE: Mount Washington, Lake of the Clouds, VII, 2, 1896 (F. Blanchard). MICHIGAN: Marquette, VI, 26 (Hubbard and Schwarz). SASKATCHEWAN: Saskatchewan River (R. Kennicott). CALIFORNIA: Mount Tallac, Eldorado County, 7000 ft., VII, 6, 1915 (C. W. Woodworth).

Description.—Blackish brown; edge of scutellum at apex, posterior margins of connexival segments, and inner margins of genital lobes, dull reddish yellow; rostrum and legs rather light reddish brown; ventral surface of abdomen dark reddish brown, with vague darker markings.

Head slightly longer than broad (32 to 30), slightly longer than pronotum (32 to 28); tylus long, strongly compressed, suddenly enlarged at base; impressions of vertex short, broad, divergent anteriorly; preocular tubercles small, obtuse; antenniferous spines very short, conical, moderately divergent, the lateral tooth obsolescent; postocular tubercles absent; antennae (fig. 38c) moderately thick, slightly shorter than head and pronotum together (57 to 60), the first segment reaching middle of tylus, length of second somewhat less than width of head including both eyes (27 to 30); rostrum extend-

ing over anterior fourth of mesosternum. Pronotum (fig. 38d) moderately convex, the lateral margins moderately expanded and but slightly reflexed, with minute and regular granulation; carinae strongly elevated. Scutellum much longer than pronotum (40 to 28), elongate-cordate, sides strongly sinuate and well elevated except at narrowly rounded apex; disc with very low rounded elevation before middle. Hemelytra broad, scarcely exposing whole width of connexivum at most, (σ) attaining apex of abdomen, corium to base of fifth segment; (φ) reaching base of genital lobes, corium to middle or almost to apex of fourth; basal expansion of exocorium moderate, rather long, reflexed; mesocorium and endocorium with several moderately distinct transverse veins; abdomen ovate, widest behind middle.

σ (fig. 38b). Fifth ventral segment slightly shorter than sixth; genital segment rather short, moderately convex, carinate. Length, 6.6 mm.

φ (fig. 38a). Dorsal genital segment peculiar (fig. 38c). Length, 7.4 to 8 mm.

Type specimens (Mount Washington, New Hampshire and Marquette, Michigan), United States National Museum, No. 12711.

This is a boreal species of rare occurrence, well distinguished by structure of the pronotum, scutellum, and female genitalia. Heidemann's figure gives its general appearance very well.

39. *Aradus (Aradus) insignitus* sp. nov. (Plate IV, fig. 39.)

Description.—Black; the third antennal segment bright orange yellow.

Similar in structure to *uniformis*, except as follows: Tylus long, strongly compressed, slightly enlarged at middle; preocular tubercles slightly developed, obtuse; antenniferous spines short, stout; antennae (fig. 39c) as thick as front femora, the first segment scarcely reaching middle of tylus, length of second almost equal to width of head including one eye (17 to 19). Pronotum (fig. 39d) distinctly convex, the lateral margins slightly expanded and strongly reflexed; carinae well elevated. Scutellum obscured. Hemelytra obscured, apparently reaching almost to apex of abdomen; basal expansion of exocorium slight.

σ . Unknown.

φ (fig. 39a). Dorsal genital segment obscured; abdomen broadly oval, the lateral margins almost entire. Length, 5 mm.

Holotype.— φ ; Massachusetts (F. G. Sanborn), in my collection.

This species is founded on a single damaged specimen which has been repaired with gum so clumsily as to obscure the scutellum and hemelytra almost entirely, but the antennal, pronotal, and genital characteristics are so distinctive that there can be no possibility of confusing it with *uniformis*, its nearest ally.

40. *Aradus (Aradus) uniformis* Heidemann (Plate III, fig. 40.)

1904. *Aradus uniformis* Heidemann, Proc. Ent. Soc. Washington, vi, p. 231.

Distribution.—MASSACHUSETTS: Chicopee, VI, 25, 1903 (F. Knab); North Saugus, 1906 (F. Mosher); Springfield (J. A. Allen). NEW YORK: Flatbush, Long Island, VI, 19, 1897 (J. L. Zabriskie); Rockaway Beach, Long Island, V, 25, 1912 (H. G. Barber); Smith's Point, Fire Island Beach, Long Island, VII, 19, 1913 (J. R. de la Torre-Bueno); Wyandanch, Long Island, VI, 3; West Point. PENNSYLVANIA: Patton, VI, 14, 1903 (M. Wirtner). MARYLAND. VIRGINIA: Fortress Monroe, IV, 19, 1891 (E. A. Schwarz). NORTH CAROLINA: Lake Toxaway (A. T. Slosson); Southern Pines, 4, V, 1906 (S. W. Foster).

Description.—Dull black; third antennal segment yellow; apical angles and more or less of posterior margins of connexival segments dull reddish yellow.

Head as long as broad, slightly longer than pronotum (24 to 22); tylus moderate, sides parallel, slightly enlarged toward apex; impressions of vertex broad, shallow, nearly parallel; preocular and postocular tubercles absent; antenniferous spines small, slender, slightly divergent, the lateral tooth obsolescent or absent; antennae (fig. 40c) moderately robust, more slender than front femora, shorter than head and pronotum together (40 to 46), the first segment reaching middle of tylus, length of second about equal to distance between eyes; rostrum reaching almost to posterior margin of prosternum. Pronotum (fig. 40d) moderately convex, the lateral margins rather strongly expanded and slightly reflexed, minutely and evenly granulate; carinae moderately elevated. Scutellum somewhat longer than pronotum (27 to 22), rather broad (20 to 27), sides distinctly sinuate at middle, strongly elevated, apex variably rounded; a low rounded elevation in basal half. Hemelytra (♂) broad, covering most of connexivum, reaching nearly to apex of genital lobes, corium about to middle of fifth segment; (♀) moderately narrowed, exposing whole connexivum at sides, reaching apex of dorsal genital segment, corium almost to apex of fourth; exocorium slightly expanded; transverse veins of corium variable.

♂ (fig. 40b). Fifth ventral segment much shorter than sixth; genital segment short, very moderately convex, the lobes large; abdomen oblong-oval, broadest behind middle. Length, 4.7 to 5 mm.

♀ (fig. 40a). Posterior margin of dorsal genital segment transverse; abdomen broadly and evenly oval. Length, 5.3 to 5.5 mm.

Type specimens (Massachusetts, Pennsylvania, Virginia), United States National Museum, No. 8153; paratypes Nos. 255.1, 255.2 in Heidemann collection, Cornell University.

This is a very distinct species not uncommonly met with, especially in beach drift; it is readily recognized by the antennal form and coloration, pronotal structure, and broad form.

41. *Aradus (Aradus) tuberculifer* Kirby (Plate V, fig. 41.)

1837. *Aradus tuberculifer* Kirby, in Richardson, Fauna Bor.-Amer., iv, p. 278, pl. 6, fig. 5.

1873. *Aradus caliginosus* Walker, Cat. Hem.-Het. Brit. Mus., vii, p. 36.

1878. *Aradus tuberculifer* Kirby, in Bethune, Can. Ent., x, p. 213.

1913. *Aradus tuberculifer* Bergroth, Can. Ent., xlv, p. 3.

Distribution.—QUEBEC: Montreal; Ottawa, V, 28, 1887. MAINE: Holden, VI, 20, 1902 (F. A. Eddy); Orono (H. T. Fernald). NEW YORK: Cranberry Lake, VII, 24, 1917 (C. J. Drake); Rockaway Beach, Long Island, VI, 26, 1910 (Wm. T. Davis). MICHIGAN. MINNESOTA. ALBERTA: Edmonton, IV, 26, 1919 (F. S. Carr). ALASKA: Iditarod, X, 15, 1918 (Alice Twichell); Old Crow, VI, 18 to 20, 1912 (J. M. Jessup); Yukon (R. Kennicott). COLORADO: (Morrison). CALIFORNIA.

Description.—Black; basal expansion and veins of corium sometimes pale brownish; posterior margins of connexival segments narrowly reddish yellow; veins of membrane sometimes narrowly whitish hyaline; rostrum and legs dark reddish brown.

Head a little longer than broad (28 to 26); longer than pronotum (28 to 25); tylus rather long, narrow, sides parallel; impressions of vertex broad, shallow, nearly parallel; preocular tubercles distinct, obtuse; antenniferous spines short, conical, moderately divergent, the lateral tooth obsolescent or absent; postocular tubercles very low, rounded; antennae (fig. 41c) moderately slender, clavate, almost as long as head and pronotum together (50 to 53), the first segment extending a little beyond middle of tylus, length of second less than width of head including both eyes; rostrum reaching apex of mesosternum. Pronotum (fig. 41d) rather flat, the lateral margins somewhat strongly reflexed, finely granulate; carinae well elevated, variably sinuate. Scutellum much longer than pronotum (35 to 25), narrow, elongate, almost triangular; sides very strongly elevated, slightly arcuate, rarely angulate at basal third; apex acute; disc with a low rounded elevation before middle. Hemelytra (♂) broad, covering abdomen, extending beyond apex of abdomen, corium nearly to apex of fifth segment; exocorium very slightly expanded; (♀) moderately narrowed, exposing almost whole width of connexivum at most, extending nearly or quite to apex of dorsal genital segment, corium about to apex of fourth; exocorium moderately expanded; transverse veins of mesocorium and endocorium variably developed.

♂ (fig. 41b). Fifth ventral segment shorter than sixth; genital segment large, strongly convex; abdomen narrow, oblong-oval, the lateral margins nearly entire. Length, 6.5 mm.

♀ (fig. 41a). Posterior margin of dorsal genital segment obscure, the usual suture between disc and lobes being obsolete; abdomen rather broadly oval, the lateral margins notched or feebly crenate. Length, 7 to 7.3 mm.

Type specimens (Canada, lat. 65°), in the British Museum.

This boreal species is readily distinguished by the shape of the second antennal segment, and the pronotal and genitalic

structure. In redescribing it and pointing out the characters which separate it from *funestus*, Bergroth²¹ remarks that Uhler's records pertain to the latter, but this is not in all cases true, since I have seen an example of the present species correctly determined by Uhler. Evidently he did not distinguish between the two forms, although both came under his observation. From correspondence with Mr. Blair, of the British Museum, I am convinced that Bergroth is correct in treating *caliginosus* as a synonym of *tuberculifer*; drawings made from Walker's type indicate identical structure of the second antennal segment and no differences in the pronotum beyond the range of ordinary variation in the species. Careful examination of several specimens indicates that the remarkable structure of the dorsal genital segment of the female described by Bergroth, may be interpreted somewhat differently. It seems to me that the discal portion of this segment is not reduced in size, but rather that the usual transverse suture or margin, between the disc and the lobes, is in this species obsolescent, slight indications of its presence being sometimes visible under high magnification.

42. *Aradus (Aradus) parshleyi* Van Duzee (Plate V, fig. 42.)

1920. *Aradus parshleyi* Van Duzee, Proc. California Acad. Sci., (4), ix, p. 336.

Distribution.—BRITISH COLUMBIA: Vernon, IV, 28, 1915 (M. H. Ruhmann).

Description.—Dark brown; postero-lateral margins of pronotum, basal expansions and most of veins of corium, posterior margins of connexival segments, and inner margins of genital lobes, yellowish; first antennal segment and basal half of second reddish brown; membrane dark brown, veins bordered inconspicuously with white; rostrum and legs pale reddish brown.

Head about as long as broad, longer than pronotum (30 to 25); tylus narrow, sides parallel; impressions of vertex broad, indefinite, curved; preocular tubercles distinct; antenniferous spines stout, conical, scarcely divergent, the lateral tooth absent; postocular tubercles small; base of head with oblique, smooth, pale lines; antennae (fig. 42c) moderately slender, almost as long as head and pronotum together, the first segment extending beyond middle of tylus, the length of the second about equal to width of head including one eye. Pronotum (fig. 42d) flattened, lateral margins minutely granulate, moderately expanded and reflexed; carinae distinctly elevated. Scutellum much longer than pronotum (35 to 25); sides moderately elevated, sinuate behind middle, nearly parallel in basal third; apex rounded; base scarcely

²¹ Canad. Ent., xlv, p. 4, (1913).

elevated. Hemicytra (♀) moderately narrowed, exposing most of connexivum, reaching apical angles of sixth segment, corium to apex of fourth; exocorium moderately expanded; mesocorium with one, endocorium without distinct transverse veins; membrane with numerous cross-veins toward apex.

♂. Unknown.

♀ (fig. 42a). Posterior margin of dorsal genital segment obscure, narrowly emarginate at middle; abdomen oval, the margins almost entire. Length, 7.5 mm.

Type specimen (Vernon, British Columbia), in the National Collection at Ottawa.

In describing this species, of which but a single specimen has been found, Van Duzee compared it with *compressus*, but it is in reality extremely close to *tuberculifer*, from which it is distinguished by the color, structure of the scutellum, slight genitalic differences, and other details. It exhibits a similar modification of the dorsal genital segment.

43. *Aradus (Aradus) funestus* Bergroth (Plate V, fig. 43.)

1913. *Aradus funestus* Bergroth, Can. Ent., XLV, p. 4.

Aradus tuberculifer Auct., in part.

Distribution.—ONTARIO: Hastings County (J. D. Evans). [DISTRICT OF COLUMBIA: Washington, VIII, 8 (O. Heidemann), *see* Van Duzee.] ALBERTA: Banff, VI, 16, 1918 (E. C. Van Dyke); Crowley, VII, 1, 1918 (R. N. Crystal); Edmonton, IV, 12, 1919 (F. S. Carr). MONTANA: Florence, VI, 3, 1912. WYOMING: Bridger Basin. COLORADO: Boulder, VI, 1899; Fort Collins (H. T. Fall); West Cliff; West Fork. ALASKA: Iditarod, IX, 5, 1917 (Alice Twichell). BRITISH COLUMBIA: Kleena Kleena, Tatler Lake, XII, 1915 (S. H. Coldwell); Metlakatla, IX, 1910 (J. H. Keen); Revelstoke, VII, 4 to 6, 1905 (J. C. Bradley); Vernon, X, 7, 1918 (W. Downes). WASHINGTON: Ellensburg; Lake Cushman, Mason County; North Yakima, IX, 20, 1903; Pullman, III, VI-II (C. V. Piper). IDAHO: Moscow. NEVADA. ARIZONA: Mohave Desert, Holcomb Valley (Calif.). CALIFORNIA: Delglades, VI, 1 to 6, 1908; Fort Crook.

Description.—Black, sometimes with brownish tinge; basal expansion and veins of corium more or less obscurely yellowish; veins of membrane with distinct narrow, whitish hyaline borders; posterior margins of connexival segments yellowish; legs and rostrum dark reddish brown.

Head structure about as in preceding except characters of antennae (fig. 42c); their length about equal to that of head and pronotum together; length of second segment equal to width of head including both eyes. Pronotum (fig. 42d) distinctly convex, lateral margins rather narrowly expanded, slightly reflexed. Scutellum pentagonal, longer than pronotum (35 to 27); sides parallel in basal half, very strongly and sharply elevated; apex acute; discal elevation rounded, rather prominent. Clavus extending beyond apex of

scutellum. Hemelytra (σ^7) extending beyond apex of abdomen, corium almost or quite to base of sixth segment, connexivum covered, exocorium scarcely expanded; (φ) extending to apex of dorsal genital segment or farther, corium almost or quite to base of fifth, width variable, partly or wholly exposing connexivum at sides, exocorium slightly expanded at base; transverse veins of corium rather numerous, variable.

σ^7 (fig. 43b). Fifth ventral segment about two-thirds as long as sixth; genital segment very large, strongly convex with sixth ventral; abdomen narrow, oblong-oval. Length, 5.7 to 6.3 mm.

φ (fig. 43a). Posterior margin of dorsal genital segment slightly and broadly arcuate, nearly straight at middle; abdomen narrowly oval. Length, 7 to 8 mm.

Type specimens (Canada, etc.) in Bergroth's collection.

This is a rather common species of wide distribution in boreal regions, easily recognized by the slender antennae and broad pentagonal scutellum. It has commonly stood in collections as *tuberculifer* Kirby.

44. *Aradus (Aradus) lugubris* Fallén (Plate V, fig. 44.)

1807. *Aradus lugubris* Fallén, Mon. Cim. Succ., p. 34.

1873. *Aradus fenestratus* Walker, Cat. Hem.-Het. Brit. Mus., vii, p. 36.

Distribution.—LABRADOR: West St. Modest. QUEBEC: Godbout, VII, 19, 1918 (E. M. Walker); Montreal Island, VI, 3, 1909 (G. Beaulieu); Ottawa, VI, 1, 1909; Port Neuf. ONTARIO: Maynooth, VII, 23, 1910 (J. D. Evans); Muskoka, VII, 1898 (E. P. Van Duzee); Rat Portage, VI, 11, 1905; Ridgeway (E. P. Van Duzee); Sudbury, 1889 (J. D. Evans). NOVA SCOTIA: Weymouth, V, 31, 1911. MAINE: Mount Katahdin, 3000 feet, VIII, 1902 (H. G. Barber); Norway; Orono, V, 10, 1914 (H. M. Parshley). NEW HAMPSHIRE: Milford (C. P. Whiting); Mount Washington, summit (A. T. Slosson). MASSACHUSETTS: Amherst, VII, 3, 1898; Beach Bluff, VI, 25. RHODE ISLAND: Kingston, VI, 17, 1906 (J. Barlow). NEW YORK: Bayshore, Long Island, IX, 1, 1910 (C. E. Olsen); Colden (E. P. Van Duzee); Ithaca, V, 7, 1904; Nyack, 1885 (J. L. Zabriskie); Rochester Junction, VI, 9, 1914 (M. D. Leonard). PENNSYLVANIA: Nicktown, VI, 1914 (M. Wirtner). DISTRICT OF COLUMBIA: Takoma Park, IV, 19, 1914 (J. D. Hood). HUDSON'S BAY TERRITORY: Ungava Bay (L. M. Turner). MICHIGAN: Marquette, VIII, 30, 1888; Newberry (R. Beebe). ILLINOIS: Algonquin, V, 10, 1896 (C. A. Hart). MINNESOTA. WISCONSIN: Beaver Dam, III, 10, 1910 (W. E. Snyder); Birnamwood, II (J. G. Sanders); Milwaukee, V. NORTH DAKOTA: Valley City, VI, 8, 1917 (P. W. Fattig). NEBRASKA: War Bonnet Canyon. MONTANA: Bozeman, VIII, 10, 1912. COLORADO: Boulder, V, 17 (T. D. A. Cockerell); Denver; Estes Park, 9350 feet, VIII, 25, 1920 (H. C. Severin); Fort Collins, V, 13, 1899; Georgetown, VII, 27, 1909 (W. J. Gerhard); Glenwood Springs (H. F. Wickham); Long's Peak Inn,

VI, 26 (T. D. A. Cockerell); Ouray (H. F. Wickham). NEW MEXICO: Clouderoft, V, 25, 1902 (H. L. Viereck); Las Vegas Hot Springs, VIII, 22 (Barber and Schwarz); Las Vegas Range, top, VI, 25, 1901 (T. D. A. Cockerell); White Mountains, 6500 feet, VII, 18 (C. H. T. Townsend). ARIZONA: Chiricahua Mountains, V, 20 (Hubbard and Schwarz); Flagstaff, VII, 7 (Barber and Schwarz); Huachuca Mountains, VIII, 24; Mud Springs, Santa Catalina Mountains, 6500 feet, VII, 17 to 20, 1916 (Lutz and Rehn); Williams, VII, 7 (Barber and Schwarz). UTAH: Alta, 10,000 feet, V, 30; Beaver Ridge Mountains, 8000 to 10,000 feet, VIII, 20. ALASKA: Chitina Glacier, 30 miles north of Mount Saint Elias, V to VI, 1912 (D. W. Eaton); Iditarod, VIII, 19, 1918 (Alice Twiehell); 60 to 75 miles north of Rampart House, VI, 23, 1912 (J. M. Jessup). ALBERTA: Banff Springs, VIII, 16 (R. P. Currie); Edmonton, IV, 26, 1919 (J. D. Evans). BRITISH COLUMBIA: Agassiz, VII, 18, 1902; Field, VII, 19, 1901; Groundhog Basin, Big Bend Country, VII, 24, 1905 (J. C. Bradley); Kaslo, VI, 13 (R. P. Currie); Kleena Kleena, Tatler Lake, X to XII, 1915 (J. C. Caldwell); Metlakatla, IX, 1910 (J. H. Keen); Revelstoke, VII, 1, 1905 (J. C. Bradley); Stickeen River (H. F. Wickham); Victoria. YUKON TERRITORY: near 60 Mile River, 1907 (T. P. Reilly). WASHINGTON: Ellensburg; Monroe, VII, 4, 1905 (E. C. Van Dyke); Olympia (T. Kincaid); Pullman, VII, 27, 1910 (J. A. Hyslop). OREGON: Portland (R. P. Currie). NEVADA: Ormsby County, VII (C. F. Baker). CALIFORNIA: Bryson, Monterey County, IV, 23, 1917 (E. P. Van Duzee); Castillea, VII, 1, 1912 (J. A. Kusché); Doble; Fallen Leaf Lake, Eldorado County, VII, 22, 1915 (E. C. Van Dyke); Eureka, VI, 20 (H. S. Barber); Fieldbrook, V, 19, 1903 (H. S. Barber); Fort Crook; Gilroy; Gold Lake Camp, Plumas County, VII, 19, 1916 (H. G. Dyar); Huntington Lake, Fresno County, 7000 feet, VII, 9, 1919 (E. P. Van Duzee); Inyo County, VII, 1913 (T. S. Brandegee); Los Angeles (D. W. Coquillett); Mesa Grande, Sonoma County, VII, 31, 1908 (F. E. Blaisdell); Mount Eddy, 9000 feet, Siskiyou County, VII, 28, 1918 (E. P. Van Duzee); Santa Cruz Mountains; Sequoia National Park, 9000 feet, VII, 19, 1907 (J. C. Bradley). PALAEARCTIC REGION.

Description.—Black, sometimes with brownish tinge; apical half of third antennal segment and sometimes extreme apex of second, and apical margins or angles of connexival segments, yellowish white; membrane whitish hyaline, with brownish maculation; ventral surface dull brown, the connexival segments spotted.

Head as long as broad, longer than pronotum (21 to 19); tylus thick, sides nearly parallel; impressions of vertex broad, rather shallow, parallel, completely connected posteriorly, forming a broad U; preocular tubercles distinct, obtuse; antenniferous spines short and rather stout, reaching middle of first antennal segment, moderately acute, parallel or slightly divergent, the lateral tooth absent; postocular tubercles low, rounded or obtuse; antennae (fig. 44c) moderately slender, often more or less flattened and variable in thickness, somewhat shorter than head and pronotum together (37 to 40), the first segment reaching middle of tylus, length of second equal to or slightly

greater than width of head between eyes; rostrum extending over anterior third of mesosternum. Pronotum (fig. 44d) moderately convex, transversely depressed before middle, the lateral margins narrowly and evenly expanded, not strongly reflexed, finely and regularly granulate; carinae moderately elevated. Scutellum longer than pronotum (29 to 19), elongate, triangular (29 to 20), sides strongly and sharply elevated; apex acute; discal elevation broad, rounded, extending beyond middle; base depressed. Hemelytra (♂ ♀) extending almost or quite to apex of abdomen, corium to base of fifth segment; exocorium not expanded at base; corium with numerous transverse veins, some of the cells more or less obscurely hyaline; endocorium with fine transverse wrinkles; corium wider than scutellum at level of middle of latter.

♂ (fig. 44b). Fifth ventral segment slightly longer than sixth, the apical margin of the sixth transverse, sinuate; genital segment large, moderately convex, the lobes short; abdomen oblong, not broader than hemelytra. Length, 4.5 to 6 mm.

♀ (fig. 44a). Posterior margin of dorsal genital segment transverse, arcuate only laterally; lobes as viewed from above (fig. 44e) rather long, posterior margin convexly arcuate; abdomen narrowly oval, wider than hemelytra, lateral margins entire. Length, 5 to 6.4 mm.

Type specimens (Westrogothia, Finland) not located.

This is a true holarctic species, of very wide distribution, as commonly met with in the New World as in the Old. It is distinguished especially by the comparatively stout antennae with second segment narrowed toward base, pronotal structure, and genital characters. The thickness and flattening of the antennae, and the posterior curvature of the female genital lobes are variable within narrow limits. Through the kindness of Mr. Blair I have been able to examine two specimens from Walker's type series of *feneustratus*. One, agreeing with the type specimen, is typical *lugubris*, the other is *abbas*; which confirms statements to the same effect made by Bergroth.²³

Aradus lugubris variety **nigricornis** Reuter

1900. *Aradus lugubris* var. *nigricornis* Reuter, Medd. Soc. Fauna et Flora Fennica, xxvi, p. 134.

Distribution.—With the typical variety.

Description.—Like the typical variety, except that the antennae are entirely black.

This variety is almost as common as the typical form, which exhibits intergradational variation in the amount of white on the antennae. It is not of geographical significance, as it occurs

²³ Canad. Entom., xlv, p. 5, (1913).

throughout the range of the species. Variety *nigricornis* is to be added on page 134 of Van Duzee's Catalogue (1917).

45. *Aradus (Aradus) arizonicus* sp. nov. (Plate V, fig. 45.)

Description.—Black; base of head with oblique pale lines; connexivum with conspicuous yellow stripes; inner margins of genital lobes yellowish; cells of corium moderately clear hyaline; membrane whitish hyaline.

Head longer than broad (25 to 22), longer than pronotum (25 to 20); tylus long, sides nearly parallel; impressions of vertex, broad, rather shallow, parallel, completely connected posteriorly; preocular tubercles very distinct, moderately acute; antenniferous spines very short and thick, not reaching middle of first antennal segment, divergent, without lateral tooth; postocular tubercles prominent, rounded; antennae (fig. 45c) moderately slender, second and third segments compressed, much shorter than head and pronotum together (37 to 45); first segment scarcely reaching middle of tylus, second longer than distance between eyes (15 to 13); rostrum extending almost to middle of mesosternum. Pronotum (fig. 25d) moderately convex, the transverse depression obsolete; lateral margins narrowly and evenly expanded, moderately reflexed, finely granulate; carinae moderately elevated. Scutellum longer than pronotum (25 to 20), rather broadly triangular (25 to 20), sides parallel at extreme base, then slightly arcuate to the very narrowly rounded apex, strongly and sharply elevated; discal elevation rounded, triangular, not extending beyond middle; base depressed. Hemelytra (♀) extending to apex of dorsal genital segment, corium to apex of fourth; exocorium not expanded at base; corium hyaline, with numerous transverse veins; endocorium without wrinkles; corium narrower than scutellum at level of middle of latter.

♂. Unknown.

♀ (fig. 45a). Posterior margin of dorsal genital segment nearly straight; lobes as seen from above (fig. 45e) short, posterior margin concavely arcuate; abdomen oval, much wider than hemelytra, the lateral margins entire. Length, 5.4 mm.

Holotype.—♀, Santa Rita Mountains, Arizona, 5-8000 feet, VI (F. H. Snow), in my collection.

This species is closely related to *lugubris*, but well distinguished by the longer head, broader scutellum, narrower hemelytra, and differently shaped genital lobes. The flattening of the antennae is probably variable, as in *lugubris*.

46. *Aradus (Aradus) angustellus* Blanchard (Plate III, fig. 46.)

1852. *Brachyrhynchus angustellus* Blanchard, in Gay's Hist. de Chile, Zool., VII, p. 205.

1863. *Aradus angustellus* Signoret, Ann. Soc. Ent. France, (4), III, p. 576.

1873. *Aradus compressicornis* Stål, Enum. Hem., 3, p. 136.

1879. *Aradus angustellus* Berg, Hem. Argent., p. 138.

Distribution.—Chili. [Buenos Ayres. Patagonia. Colombia.]

Description.—Blackish brown; apical margins of connexival segments broadly pale; membrane maculated, pale along the veins.

Head slightly longer than broad (24 to 22), longer than pronotum (24 to 20); tylus comparatively large, thick, sides nearly parallel; impressions of vertex short, broad, rather deep, widely separated, parallel, connected posteriorly; preocular tubercles distinct, obtuse; antenniferous spines short, moderately stout, slightly divergent, without lateral tooth; postocular tubercles rather prominent, rounded; antennae (fig. 46c) moderately stout, shorter than head and pronotum together (38 to 44), the first segment reaching scarcely to middle of tylus, second and third very distinctly flattened, the second narrowed only at extreme base and as long as distance between eyes; rostrum reaching about to middle of mesosternum. Pronotum (fig. 46d) moderately convex, the lateral margins rather broadly expanded and distinctly reflexed, very finely granulate, variably sinuate anteriorly; carinae narrow, distinctly elevated. Scutellum much longer than pronotum (30 to 20), triangular; sides strongly elevated, variably areolate; apex very narrowly rounded; discal elevation rather small and high; base depressed. Hemelytra (♀) extending almost or quite to genital lobes, corium over base of fifth segment; exocorium not expanded at base; transverse veins of corium numerous.

♂. Not at hand.

♀ (fig. 46a). Posterior margin of dorsal genital segment bisinuate, emarginate at middle; abdomen narrowly oval, but little broader than hemelytra. Length, 5 to 5.7 mm.

Type specimens (Chile) not located.

There are examples of this South American species in the Uhler collection (U. S. N. M.), from Chile, and it is reported by Stål and others from various parts of the continent. It is readily distinguished from *lugubris* by the antennal structure and genital traits. I have not seen specimens of this species other than those mentioned above, but its characters are so distinctive that I think there can be no doubt regarding the identification.

47. *Aradus (Aradus) abbas* Bergroth (Plate V, fig. 47.)

1889. *Aradus abbas* Bergroth, Bull. Soc. Ent. Belgique, p. clxxx.

Distribution.—NEWFOUNDLAND. QUEBEC: Bondville, VII, 28, 1915; Montreal, VII, 10, 1909 (H. Groh); Ottawa, VII, 7, 1907 (C. H. Young). ONTARIO: Maynooth, VII, 10, 1907 (J. D. Evans); Scotia, VII, 31, 1911 (M. C. Van Duzee); Sudbury, V, 18, 1889; Trenton, VII, 3, 1910 (J. D. Evans). NEW BRUNSWICK: St. John, VI, 14, 1908 (G. Beaulieu). MAINE: Ashland Junction, VIII, 16, 1910 (C. W. Johnson); Cumberland County, VI, 1916 (A. Nicolay); Fort Kent, VIII, 17, 1910 (C. W. Johnson); Machias, VIII, 17 (C. W. Johnson); Mount Katahdin, 3000 feet, VIII, 1902 (H. G. Barber);

Saddleback Lake, VII, 18 to 20, 1916. VERMONT: St. Johnsbury, VI, 27, 1906 (C. W. Johnson). NEW HAMPSHIRE: Mount Washington; Three Mile Island, V, 23, 1908 (F. Blanchard). MASSACHUSETTS: Beach Bluff, VI, 30, 1915 (H. M. Parshley); Boston, IX, 1; Concord, IV, 26, 1913 (W. Reiff); Mount Wachusett; Tyngsboro, 1893 (F. Blanchard). CONNECTICUT: New Haven, IV, 24, 1915 (Q. S. Lowry), VII, 31, 1911 (A. B. Champlain); Walkingtonford, VI, 5, 1912 (D. J. Caffrey). NEW YORK: Axton, Adirondack Mountains, VI, 12 to 22, 1901 (MacGillivray and Houghton); Buffalo, V, 27, 1911 (M. C. Van Duzee); Colden; Bayshore, Long Island, IX, 4, 1910 (C. E. Olsen); Fire Island Beach, Smith's Point, VII, 9, 1915 (J. R. de la Torre-Bueno); Hamburg, VI, 28, 1896 (E. P. Van Duzee); Ithaca, VII, 2, 1911 (C. R. Plunkett); Saranac Lake; Wading River, Long Island, V, 30, 1915 (F. M. Schott); White Plains, VIII, 11, 1911 (J. R. de la Torre-Bueno). PENNSYLVANIA: Penn Station, VII, 5, 1904 (M. Wirtner). DISTRICT OF COLUMBIA: Washington, VIII, 1, 1913 (R. C. Shannon). VIRGINIA: Falls Church, VII, 10 (N. Banks). NORTH CAROLINA: Lake Waccamaw, IV, 16, 1917 (R. W. Leiby); Terra Ceia, IX, 1919 (R. W. Leiby). FLORIDA: Jacksonville (A. T. Slosson). MICHIGAN: Marquette, VIII, 28, 1888; Sault Sainte Marie (H. Osborn). ILLINOIS: Chicago, VII, 13, 1911 (C. A. Hart). WISCONSIN: Cranmoor, VI, 15, 1910 (C. W. Hooker). ALASKA: Fort Yukon, VI, 26 to 30, 1916 (J. A. Kutsche); Iditarod, VII, 7, 1918 (Alice Twichell). BRITISH COLUMBIA: Revelstoke, VII, 4 to 6, 1905 (J. C. Bradley); Vancouver, Stanley Park; Victoria. WASHINGTON: Hoquiam, VII, 22, 1904 (Burke); Lake Cushman, Mason County, VII, 8, 1919 (F. M. Gaige); Olympia (T. Kincaid); Tacoma. CALIFORNIA: Blue Lake, Humboldt County, VI, 20 to 27, 1907 (J. C. Bradley).

Description.—Black; apex of second and apical half of third antennal segments and apical angles of connexival segments white or yellowish; basal region of exocorium with a small, elongate yellowish translucent spot; membrane hyaline, with large dark quadrate spots; disc of abdomen beneath reddish, variably spotted.

Head about as long as broad and as long as pronotum; tylus short, slightly bulbous; impressions of vertex rather narrow and deep, widely separated, parallel, connected posteriorly, bounded posteriorly by oblique smooth lines; preocular tubercles distinct, obtuse; antenniferous spines small, acute, moderately divergent, the lateral tooth absent or obsolescent; postocular tubercles scarcely indicated; antennae (fig. 47c) very slender, about as long as head and pronotum together, the first segment reaching middle of tylus, the length of the second slightly greater than width of head including one eye (19 to 17); rostrum extending over anterior third of mesosternum. Pronotum (fig. 47d) convex, the expanded lateral margins very narrow and not reflexed, finely and irregularly granulate, often with a few minute denticles anteriorly, the anterior angles with irregular teeth, antero-lateral margins nearly straight or slightly concave; the postero-lateral angles somewhat variably shaped; carinae moderately elevated. Scutellum moderately elongate, nearly triangular, longer than pronotum (27 to 22); sides parallel in basal sixth, straight

or slightly arcuate to acute or very narrowly rounded apex, rather strongly and sharply elevated; the discal elevation rounded, higher than sides. Hemelytra (♂ ♀) extending almost or quite to apex of abdomen, corium about to middle of fifth segment, exocorium very slightly expanded at base; mesocorium with one, endocorium without distinct transverse veins.

♂ (fig. 47b). Fifth ventral segment very much shorter than sixth on median line, exhibiting characteristic structure; genital segment large, very strongly convex; abdomen ovate, broadest behind middle, lateral margins notched. Length, 4.6 to 4.9 mm.

♀ (fig. 47a). Posterior margin of dorsal genital segment with small notch at middle, arcuately oblique on each side; abdomen elongate-oval, broadest at middle, the lateral margins almost entire. Length, 5.1 to 5.9 mm.

This is a very striking species, widely distributed and represented in most collections; it is readily recognized by the slender, biannulate antennae, pronotal form, and genitalic characters. In the male the ventral segments are modified in a manner peculiar to this species and *gracilicornis*, which renders identification of this sex certain at a glance. In many collections specimens of *abbas* stand under the name *breviatus*, and, indeed, the relations between these species are still problematical, as noted below.

48. *Aradus (Aradus) breviatus* Bergroth (Plate V, fig. 48.)

1887. *Aradus breviatus* Bergroth, Rev. Ent., vi, p. 245.

Distribution.—East Florida (W. H. Ashmead).

Description.—Color and structure as in the preceding, except as follows: Postero-lateral margins of pronotum distinctly oblique (fig. 48d); hemelytra (♀) extending well beyond apex of abdomen.

♂. Unknown.

♀ (fig. 48a). Dorsal genital segment apparently much abbreviated, the second genital segment visible from above (through the wings); ventral segments as in the preceding, except that the genital lobes are truncate, scarcely extending beyond apex of first genital segment. Length, 5 mm.

Type specimen (Florida) in Bergroth's collection.

Through the kindness of Dr. Bergroth I have been enabled to examine the type and only known specimen of this species. It presents no characteristics wholly foreign to *abbas*, except in the structure of the genital lobes and the dorsal genital segment. In size, form of pronotum and of scutellum, and details of the genital segments this individual exhibits certain minor peculiarities, but scarcely such as to be considered beyond the range of variation in *abbas*. For example, in a male specimen of *abbas*

from Florida, sent to me by Mrs. A. T. Slosson, the postero-lateral margins of the pronotum are of a form intermediate between the conditions shown in figs. 47d and 48d, while in all other respects the specimen is typical. The remnants of the genital lobes in Bergroth's type lack the spiracles normally situated on the margin and the apical edges show some signs of abnormality when viewed under the highest powers, so that the aberrant nature of the specimen may possibly be due to an injury occurring perhaps during one of the later nymphal stages. Bergroth writes: "I have not seen the male of this species and do not know how it is to be distinguished from *abbas* ♂; yet *breviatus* does not seem to be an abnormal specimen of *abbas*, as the female genitalia are quite symmetrical on each side"; and I agree that in the absence of adequate material from Florida judgment must be suspended. It is worthy of mention in this connection that in one example of *lugubris* which has come under my observation the genital lobe of one side is similarly abbreviated.

49. *Aradus* (*Aradus*) *gracilicornis* Stål (Plate V, fig. 49.)

1873. *Aradus gracilicornis* Stål, Enum. Hem., 3, p. 136.

1887. *Aradus gracilicornis* Bergroth, Rev. Ent., vi, p. 246.

Distribution.—GEORGIA: Thomasville, III, 6, 1903 (Hebard). FLORIDA: Baldwin; Biscayne Bay, I to VI (A. T. Slosson); Crescent City, IV, 1908 (E. P. Van Duzee); Lake Worth, VI, 2, 1887; St. John's River, V, 3, 1918. MISSISSIPPI: Agricultural College, IV, 30, 1915. TEXAS: Agricultural College. NEW MEXICO: Albuquerque. ARIZONA: Santa Rita Mountains, VI, 12, IX, 23. CUBA.

Description.—Black or dark brown, the hemelytra contrastingly pale; second and third antennal segments darker toward tip, sometimes very narrowly and inconspicuously pale at extreme apex; oblique pale lines at base of head very distinct; cells of corium hyaline, the veins yellowish or brown; base, apex, and more or less of lateral margin of corium beyond basal third, dark brown; clavus hyaline, dark at base and apex; membrane hyaline, with very faint brownish maculation; apical angles of connexival segments yellow, conspicuously in female, obscurely in male; rostrum and legs dark brown; ventral surface dark brown, sometimes marked with yellow along sutures, connexivum spotted.

Head a little, or scarcely, longer than broad, about as long as pronotum; tylus moderate in size, slightly bulbous; impressions of vertex short, nearly parallel, widely separated, connected posteriorly; preocular tubercles distinct, rather acute; antenniferous spines small, slender, moderately diver-

gent, without lateral tooth; postocular tubercles obsolescent; antennae (fig. 49c) slender, somewhat variable in thickness, as long as head and pronotum together, the first segment reaching about to middle of tylus, the length of the second almost equal to width of head including one eye; rostrum extending to middle of mesosternum. Pronotum (fig. 49d) convex, lateral margins narrowly expanded, evenly granulated, with a few coarse, variable teeth anteriorly; carinae well elevated. Scutellum longer than pronotum (28 to 22), sides parallel in basal fourth, then more or less distinctly sinuate to the narrowly rounded apex, moderately elevated; disc just before middle and basal angles moderately elevated, with connecting, lower ridges. Hemelytra (σ) extending to apex of abdomen, corium to middle of fifth segment, connexivum not fully exposed at sides; (φ) extending to middle or apex of dorsal genital segment, corium to apex of fourth, connexivum exposed; exocorium very slightly expanded at base; mesocorium with one, endocorium without distinct transverse veins.

σ (fig. 49b). Fifth ventral segment deeply emarginate, very short at middle; genital segment very long, moderately convex; abdomen narrowly oval, the lateral margins entire. Length, 4.75 mm.

φ (fig. 49a). Dorsal genital segment broad, posterior margin slightly arcuate, notched at middle; fifth ventral segment with a transverse, sinuate, linear impression before middle; abdomen rather broadly oval, lateral margins almost entire, feebly prominent at apical angles of connexival segments. Length, 5 to 5.8 mm.

Type specimen (Cuba) in the Stockholm Museum.

Although comparisons with the type have not been made, I think there can be no doubt that this species is correctly located, as I find entire agreement with the original description and with Bergroth's (1887) statement of the female characters. The structure of the genital segments in both sexes is sufficient to distinguish it from all others, except *abbas* σ , the short genital lobes, as viewed from above, being characteristic. From *evermanni*, often determined as this species, it is readily separated by its larger size, non-reticulate corium, etc. I find that this species has often been misidentified as *breviatus*, an error due, no doubt, to the shortness of the genital lobes in the female, as viewed from above, although this abbreviation is by no means excessive and does not approach that characteristic of the species mentioned.

50. *Aradus (Aradus) marginatus* Uhler (Plate V, fig. 50.)

1893. *Aradus marginatus* Uhler, Proc. Ent. Soc. Washington, II, p. 384.

Distribution.—UTAH: Alta, VI, 30, 1891 (E. A. Schwarz); Park City, VI, 17, 1891 (E. A. Schwarz).

Description.—Dark brown, with extensive pale markings, giving a general light brown effect; antennae light brown, apex of second and apical half of third pale, fourth black; preocular tubercles and antenniferous spines yellow at apex; postero-lateral region of pronotum and carinae posteriorly yellow; basal expansion, except anteriorly, and discal veins of corium yellow, the cells hyaline; membrane hyaline, with pale brown maculation; connexivum moderately dark brown, the segments posteriorly, and the inner margins of genital lobes, yellow; legs reddish brown, apices of femora pale; rostrum and ventral surface dark reddish brown, the abdomen marked laterally with yellow.

Head as long as broad, longer than pronotum (21 to 17); tylus short, broad, slightly bulbous; impressions of vertex moderately deep, irregular, widely separated, a little divergent anteriorly; preocular tubercles large, rather acute; antenniferous spines long, slender, strongly divergent, with a very small lateral tooth near base; postocular tubercles prominent, rounded; antennae (fig. 50c) slender, shorter than head and pronotum together (35 to 39); the first segment reaching middle of tylus, and but little beyond apices of antenniferous spines, the second in length about equal to width of head between eyes; rostrum extending over anterior third of mesosternum. Pronotum (fig. 50d) moderately convex, the lateral margins narrowly expanded and slightly reflexed, finely granulated, with a few small teeth anteriorly; carinae slender, slightly elevated. Scutellum longer than pronotum (21 to 17), shield-shaped, its width equal to length of pronotum; sides slightly curved, strongly elevated except at rounded apex; discal elevation triangular; extreme base depressed. Hemelytra (♂) extending almost to apex of abdomen, corium to apex of fourth segment, connexivum partially exposed at sides; elytra (♀) narrowed but slightly toward apex, exposing connexivum at sides, extending to middle or nearly to apex of dorsal genital segment, corium to middle or apex of fourth; exocorium scarcely expanded; whole corium with numerous rather poorly developed transverse veins, not hyaline.

♂ (fig. 50b). Fifth ventral segment a little shorter than sixth; genital segment slightly convex, rather long, the lobes short; abdomen ovate, broadest behind middle, margins almost entire. Length, 4 mm.

♀ (fig. 50a). Posterior margin of dorsal genital segment slightly arcuate, faintly emarginate at middle; abdomen narrowly oval, the lateral margins almost entire. Length, 5 mm.

Type specimens (Utah) in the Uhler collection, United States National Museum, No. 2479, lectotype, in the Heidemann collection, Cornell University, paratypes Nos. 254.1, 254.2.

Of this well-marked species no specimens have come to light since the discovery of the original series by Schwarz. From allied forms it is readily distinguished by its coloration as well as by details of antennal, pronotal, and genitalic structure.

51. *Aradus (Aradus) uniannulatus* sp. nov. (Plate VI, fig. 51.)

Description.—Black; third antennal segment pale yellowish in apical third; base of head with oblique pale lines; posterior margins of connexival segments narrowly pale, the bands becoming indistinct inwardly; membrane hyaline, with faint brownish maculation.

Head about as long as broad and as long as pronotum; tylus rather short and broad, rounded at apex, enlarged at base; impressions of vertex broad, shallow, widely separated, nearly parallel, connected posteriorly; preocular tubercles small but distinct; antenniferous spines short, slightly divergent, without lateral tooth; postocular tubercles rather low, rounded; antennae (fig. 51c) very slender, almost as long as head and pronotum together (37 to 40), the first segment extending beyond middle of tylus and well beyond apex of antenniferous spines, the second in length equal to width of head including one eye; rostrum reaching almost or quite to middle of mesosternum. Pronotum (fig. 51d) slightly convex, the lateral margins moderately expanded and distinctly reflexed, denticulate anteriorly; carinae distinctly elevated. Scutellum somewhat longer than pronotum (23 to 20), rather broad (23 to 17), the sides nearly straight to apical third, then slightly arcuate to the very narrowly rounded or almost acute apex, slightly elevated, scarcely so toward apex; discal elevation rounded, slightly higher than margins at middle; base depressed except at angles. Hemelytra (σ) broad, covering connexivum, reaching apex of abdomen, corium beyond middle of fifth segment; (φ) very slightly narrowed toward apex, narrowly exposing connexivum at sides, reaching genital lobes, corium over base of fifth; exocorium not expanded at base; mesocorium and endocorium with numerous indistinct transverse veins; cells not hyaline.

σ (fig. 51b). Fifth ventral segment about as long as sixth; genital segment rather long, moderately convex, the lobes short, with straight, oblique posterior margins and very small median notch; abdomen oblong-oval, the margins nearly entire. Length, 4.2 mm.

φ (fig. 51a). Posterior margin of dorsal genital segment slightly arcuate, straight at middle; abdomen narrowly oval, the lateral margins entire; lobes rather short, sharply angulate at apex. Length, 4.4 to 5 mm.

Holotype.— φ ; Edmonton, Alberta, IV, 17, 1919 (F. S. Carr), in my collection.

Allotype.— σ ; Pinelawn, Long Island, New York, V, 12 (Wm. T. Davis), in my collection.

Paratypes.—Females; Edmonton, Alberta, V, 9, 1919; V, 23, 1919; V, 28, 1919 (F. S. Carr), in G. A. Moore's collection and in mine; Marquette, Michigan, VIII, 28, 1888, in my collection; Washington, D. C., XI, 20 (O. Heidemann), on *Pinus inops*, in the Heidemann collection, Cornell University, paratype No. 552.1.

This species, which the few specimens at hand show to be of rather wide distribution, is related to *marginatus* and to *evermanni*. From the former it is distinguished by color and by its longer second antennal segment, and from the latter by antennal coloration, opaque corium, and larger average size. The structural details of pronotum, scutellum, and genital segments are distinctive.

52. *Aradus* (*Aradus*) *evermanni* Van Duzee (Plate VI, fig. 52.)

1920. *Aradus evermanni* Van Duzee, Proc. California Acad. Sci. (4), ix, p. 33.

Distribution.—TEXAS. ARIZONA: Huachuca Mountains, VII, 17, 1905 (H. G. Barber); Chiricahua Mountains, VI, 9 (H. G. Hubbard). CALIFORNIA: Gilroy; San Francisco, IX, 16, 1917 (E. P. Van Duzee).

Description.—Black; lateral margins of pronotum, corium except base and apex, and sometimes the three basal segments of antennae and the connexivum, obscure brown; connexivum with conspicuous pale bands.

Head slightly broader than long, about as long as pronotum; tylus short and very thick, slightly bulbous toward apex; impressions of vertex short, narrow, shallow, widely separated, parallel, connected posteriorly; preocular tubercles small; antenniferous spines short, rather stout, conical, moderately divergent, without lateral tooth; postocular tubercles well developed, obtuse; antennae (fig. 52c) shorter than head and pronotum together (28 to 34), the first segment reaching middle of tylus, length of second somewhat more than width of head including both eyes (13.5 to 12); rostrum extending almost to middle of mesosternum. Pronotum (fig. 52d) much shorter than head, the lateral margins slightly expanded and reflexed, very finely and regularly denticulate; carinae well elevated. Scutellum rather broad, variable (13.5 or 15 to 20), longer than pronotum (20 to 15), triangular, sides very slightly curved toward the narrowly rounded apex, moderately elevated; discal elevation slightly higher than margins, V-shaped. Hemelytra (♂ ♀) extending nearly to apex of abdomen, corium more or less over the fifth segment; basal expansion of exocorium very slight; corium hyaline, with numerous distinct transverse veins.

♂ (fig. 52b). Fifth ventral segment two-thirds as long as sixth; genital segment rather large, slightly convex, the lobes very short; abdomen narrowly oval, apical angles of the segments slightly prominent. Length, 3.7 mm.

♀ (fig. 52a). Posterior margin of dorsal genital segment transverse, slightly sinuate; genital lobes almost transverse, contiguous or nearly so at middle. Length, 4.5 mm.

Type specimen (San Francisco, California), California Academy of Sciences, No. 686.

This species is distinguished by its small size, reticulate corium, and very distinct genital characters; I have come across several specimens in collections determined as *gracilicornis*, and some of Bergroth's and Heidemann's published records of the latter pertain to *evermanni*. The rostral length given in the original description is erroneous, the mistake being due to a superabundance of adhesive used in mounting the type specimen.

53. *Aradus (Aradus) falleni* Stål (Plate VI, fig. 53.)

1860. *Aradus Falleni* Stål, Rio Jan. Hem., 1, p. 68.

1873. *Aradus Falleni* Stål, Enum. Hem., 3, p. 136.

1886. *Aradus Falleni* Bergroth, Wiener Ent. Zeit., v, p. 97.

1898. *Aradus falleni* Champion, Biol. Cent.-Am., Het. II, p. 66, pl. 5, fig. 1.

Distribution.—RHODE ISLAND: Providence (C. A. Davis). CONNECTICUT: New Haven, VI, 18, 1919 (M. P. Zappe). NEW YORK: Rockaway Beach, Long Island, VI, 27, 1909 (J. R. de la Torre-Bueno); Yaphank, Long Island, IX, 26, 1912 (J. R. de la Torre-Bueno). NEW JERSEY: Nassau, III, 27, 1879 (E. A. Schwarz); Roselle Park, V, 13, 1915 (H. G. Barber). PENNSYLVANIA: Allegheny. DISTRICT OF COLUMBIA: Washington, VII, 10 (Kotinsky). MARYLAND: Baltimore, V, 27 (P. R. Uhler). VIRGINIA: Falls Church, V, 21 (N. Banks); Herndon, VIII, 1911 (H. G. Barber); Saint Elmo, X, 5, 1901; Virginia Beach, VII, 17. WEST VIRGINIA: Berkeley Springs, VII, 25, 1887. NORTH CAROLINA: Black Mountains, V, 18; Lake Nington, VI, 8, 1906 (F. Sherman); Raleigh, V, 1, 1904 (F. Sherman); Southern Pines, III, 4, 1915 (A. H. Mance); Swannanoa, VI, 1919 (F. Sherman); Tryon, V, 20, 1903 (W. F. Fiske). GEORGIA: Atlanta, V, 1899 (E. P. Van Duzee); Spring Creek, Decatur County, VI, 7 to 23, 1911 (J. C. Bradley). FLORIDA: Biscayne Bay, V, 21, 1887; Crescent City, IV, 1908 (E. P. Van Duzee); Jacksonville (A. T. Slosson); Key West, VI, 10, 1887; La Belle, IV, 28, 1912 (Wm. T. Davis); Lake Worth (P. R. Uhler); Miami, XII, 7, 1912 (F. Knab); Sanford, V, 3, 1908 (E. P. Van Duzee); West Palm Beach, V, 27, 1912 (C. Dury). MISSISSIPPI: Agricultural College, IV, 24, 1915; Vicksburg, VII, 14, 1899 (J. S. Hine). ILLINOIS: Homer, V, 1, 1915 (C. A. Hart); Urbana (C. A. Hart). MISSOURI: Columbia, VI, 1897 (F. J. Hall). ARKANSAS: Little Rock, VII, 13, 1904 (H. S. Barber). OKLAHOMA: South McAlester (Ind. Terr.) (H. F. Wickham). LOUISIANA: Baton Rouge, IV, 14, 1915 (T. H. Jones); Shreveport. TEXAS: Austin. NEW MEXICO: Albuquerque; Highrolls, VI, 31, 1902 (H. L. Viereck). ARIZONA: Bright Angel, VII, 10 (Barber and Schwarz); Fort Grant, VII, 15 (H. G. Hubbard); Santa Rita Mountains, VI, 13. BRITISH COLUMBIA: Revelstoke, VII, 1, 1905 (J. C. Bradley); Vancouver; Victoria. CALIFORNIA: Bryson, IV, 24, 1917 (E. P. Van Duzee); Fort Crook; Fresno, V, 21 (E. A. Schwarz); Los Angeles (D. W. Coquillett); Mount Eddy, summit, 9000 feet, Siskiyou County, VII, 28, 1918 (E. P. Van Duzee); Redding, VII, 7, 1918 (E. P. Van Duzee); San Diego County, VII, 9, 1913 (E. P. Van Duzee); Santa

Cruz Mountains; Sonoma County. MEXICO: Izamal, Yucatan, IV (C. H. T. Townsend). PANAMA: Las Cascadas, Canal Zone, III, 5, 1909 (A. H. Jennings). BRAZIL: Rio Janeiro. [WEST INDIES, *sec.* Bergroth.]

Description.—Black; antennae usually pale brown except first segment and base of second; cells of corium and membrane whitish hyaline; posterior margins of connexival segments and inner margins of genital lobes yellowish white; rostrum and legs brown.

Head slightly broader than long (21 to 20), about as long as pronotum; tylus short, sides parallel; impressions of vertex short, broad, shallow, broadly connected posteriorly; preocular tubercles distinct, obtuse; antenniferous spines rather short and stout, slightly divergent, without lateral tooth; postocular tubercles obsolescent; antennae (fig. 53c) moderately slender, much shorter than head and pronotum together (28 to 40), the first segment reaching about to middle of tylus, length of second about equal to width of head between eyes; proportions of the segments slightly variable; rostrum extending about to base of prosternum. Pronotum (fig. 53d) strongly convex, the lateral margins slightly expanded, distinctly reflexed, granulate; carinae distinctly elevated. Scutellum elongate, triangular, longer than pronotum (26 to 20); sides strongly elevated; disc slightly elevated near base; apex extremely narrowly rounded. Hemelytra (σ^7 ♀) extending to genital lobes or further, corium to base of fifth segment: (σ^7) nearly parallel, covering most of abdomen, or (♀) a little narrowed apically, exposing connexivum at sides; exocorium very slightly expanded at base; mesocorium with one to three, endocorium without distinct transverse veins; veins of membrane simple. Abdomen oblong, lateral margins entire.

σ^7 (fig. 53b). Fifth ventral segment distinctly shorter than sixth, which is transverse and sinuate at apex medially; genital segment very short, moderately convex, fenestrate. Length, 3.75 to 4.25 mm.

♀ (fig. 53a). Dorsal genital segment transverse at apex. Length, 4.5 to 5 mm.

Type specimen (Brazil) in the Stockholm Museum.

This species is found throughout the New World, except in the most northern and southern regions, thus inhabiting most of the faunal zones, and yet it exhibits no considerable degree of variation and is always easily recognized. Its chief distinguishing characters are in the structure of the antennae and pronotum, the peculiar male genital segment, and the hyaline membrane. As remarked by Bergroth (1886), the color of the antennae is variable; usually light brown, but sometimes nearly black or dull white.

54. *Aradus (Aradus) snowi* Van Duzee (Plate VI, fig. 54.)

1920. *Aradus snowi* Van Duzee, Proc. California Acad. Sci., (4), ix, p. 339.

Distribution.—ARIZONA: Chiricahua Mountains, VI, 9 (H. G. Hubbard); Huachuca Mountains, VII, 13, 1905 (H. G. Barber); Palmerlee; Santa Rita Mountains, 5000 to 8000 feet, VI (F. H. Snow). NEW MEXICO: Alamogordo, V, 2, 1902 (Viereck and Rehn).

Description.—Black to dark brown; expanded pronotal margins and most of corial veins a little paler; cells of corium and membrane whitish hyaline, the latter with quadrate brownish spots; third antennal segment except sometimes extreme base, apical half of second, and basal half of fourth, yellowish white; apical angles of connexival segments with yellowish white spots, becoming larger posteriorly.

Head about as broad as long, longer than pronotum (19 to 15); tylus moderate in size, somewhat enlarged toward base; impressions of vertex broad, confluent, occupying most of surface between eyes and embracing an anterior elevated area; a narrow carina near each eye; preocular tubercles obsolescent; antenniferous spines rather short and stout, slightly divergent, without lateral tooth; postocular tubercles slight, rounded; antennae (fig. 54c) rather stout, much shorter than head and pronotum together (25 to 34), the first segment reaching a little beyond middle of tylus, length of second equal to distance between eyes; rostrum extending over anterior third of mesosternum. Pronotum (fig. 54d) moderately convex, the lateral margins narrowly expanded and but little reflexed, minutely granulate, translucent; carinae distinct, more or less arcuate. Scutellum elongate, triangular, much longer than pronotum (20 to 15); sides nearly or quite straight, strongly elevated; apex narrowly rounded; disc feebly elevated near base. Hemelytra (♂) reaching apex of abdomen, corium to middle of fifth segment, connexivum largely covered; (♀) reaching middle of dorsal genital segment, corium to middle of fourth, connexivum exposed at sides; exocorium scarcely expanded at base; mesocorium and endocorium with several more or less irregular transverse veins; veins of membrane mostly simple, the cross-veins obsolescent.

♂ (fig. 54b). Fifth ventral segment slightly longer than sixth, apical margin of latter broadly angulate; genital segment rather short, slightly convex; abdomen oblong-oval, the lateral margins entire. Length, 3.75 to 4 mm.

♀ (fig. 54a). Posterior margin of dorsal genital segment arcuate as a whole, the median emargination distinct, broader than space between genital lobes, widest anteriorly; abdomen oval, margins entire. Length, 4.5 mm.

Type specimen (Santa Rita Mountains, Arizona) in Van Duzee's collection.

This curious species, rather closely related to *falleni*, may be recognized immediately by the thick, black and white antennae, as well as by pronotal and genitalic characters. It was described

from a single specimen, but I have come upon a moderate number in collections, for the most part confused with *falleni*, even by Heidemann.

55. *Aradus (Aradus) cinnamomeus* Panzer (Plate VI, fig. 55.)

1794. *Aradus cinnamomeus* Panzer, Faun. Ins. Germ., heft 100, p. 20.

1873. *Aradus cinnamomeus* Stål, Enum. Hem., 3, p. 137.

Distribution.—MASSACHUSETTS. NEW YORK: Bay Shore, Long Island, VII, 3, 1909 (C. E. Olsen); Staten Island, IV, 4 (Wm. T. Davis); Wyandanch, Long Island, IV, 30, 1910 (Wm. T. Davis); Yaphank, Long Island, IX, 25, 1912 (J. R. de la Torre-Bueno). NEW JERSEY: Lahaway, V, 30, 1916 (C. E. Olsen); Lakehurst, VIII, 21, 1909. PENNSYLVANIA. DISTRICT OF COLUMBIA: Rock Creek, V, 27, 1891 (O. Heidemann); Washington, III, 27, VIII, 30 (O. Heidemann). MARYLAND: Glen Echo, VI, 2, 1893, (O. Heidemann); Plummer's Island, IV, 6, 1913 (W. L. McAtee); Sugarloaf Mountain, IX (O. Heidemann). VIRGINIA: Bluemont, VII, 1, 1914 (W. L. McAtee); Mount Vernon, II, 28, 1915 (W. L. McAtee); Rosslyn, IV, 9, 1905 (J. G. Sanders). WEST VIRGINIA: Berkeley Springs, VI, 4, 1886. NORTH CAROLINA: Southern Pines (A. H. Manee); Southport, IV, 10, 1914; Tryon, 1903 (W. F. Fiske). GEORGIA: Clayton, V, 18 to 26, 1911 (J. C. Bradley). ALABAMA: Eufaula, II, 24 (E. A. Schwarz). NEBRASKA: Glen, VIII, 1903. [MISSOURI. TEXAS.] CALIFORNIA: San Bernardino County, V, 30, 1916 (C. Dury). PALAEARCTIC REGION.

Description.—Yellowish or reddish brown; eyes and antennae toward apex darker; a series of small, double, dark spots just within connexival suture; membrane whitish hyaline.

Head very slightly broader than long, almost twice as long as pronotum; tylus very thick, rounded at apex, basal suture conspicuous; impressions of vertex shallow, indefinite, nearly parallel; preocular and postocular tubercles absent; antenniferous spines stout, strongly divergent, with distinct lateral tooth; antennae (fig. 55c) short and thick, very little longer than head, the first segment reaching about to middle of tylus, length of second scarcely one-third width of head including both eyes; rostrum reaching apex of mesosternum. Pronotum (fig. 55d.2) moderately convex or flat, the lateral margins moderately expanded, not reflexed, finely granulate or denticulate; carinae very slightly developed, obsolete anteriorly. Scutellum almost or quite one-half longer than pronotum, the sides slightly and obtusely elevated; disc very slightly raised in basal half; apex rounded. Abdomen broadly oval, lateral margins almost entire.

♂, stenopterous (figs. 55b, 55d.3). Pronotum small, flat; scutellum narrow. Hemelytra strongly narrowed at middle, enlarged at apex (as in fig. 60d.3), extending to base of genital lobes, corium to genital segment; corium and membrane with distinct venation. Fifth ventral segment about half as long as sixth; genital segment large, strongly convex, lobes rather long (fig. 55b). Length, 3.1 to 3.8 mm.

♀, dimorphic (fig. 55a). Posterior margin of dorsal genital segment emarginate at middle, slightly oblique at sides. Length, 3.8 to 5 mm.

Macropterous form (fig. 55d.2). Pronotum moderately convex; hemielytra broad, covering most of disc of abdomen, extending over base of dorsal genital segment, corium to apex of fourth.

Brachypterous form (fig. 55d.1). Pronotum reduced in size, flat; hemielytra slightly longer than scutellum, costal margin broadly rounded; membrane absent or slightly developed.

Type specimens not located.

This species, of holarctic range, is readily recognized by its small size, reddish color, short and thick antennae, etc. It is certainly a member of the subgenus *Aradus*, but in type of wing polymorphism it exhibits a striking similarity to *heidemanni*, of the subgenus *Quilnus*, an example of the interrelations which obtain throughout the genus. The narrow hemielytra of the male are in reality an indication of brachyptery in the broad sense, *i. e.*, wing reduction, for the pronotum is characteristically flattened and the hind wings are absent. After comparison with numerous European examples, I find nothing distinctive in the American material, except possibly a somewhat smaller average size, and can thus confirm Stål's remark, "Specimen unicum texanum a speciminibus europaeis distinguere nequeo." *Cinnamomus* is usually taken in beating pine branches, rather than by searching under sheets of dead bark, and in fact its habits are quite different from those of other species. It is to be hoped that Mr. Wm. T. Davis or some other well qualified American observer will give this matter his attention, since but little has been done on it in this country. Kiritshenko²³ writes as follows: "In the district of St. Petersburg, according to L. W. Bianki, *Aradus cinnamomus* occurs in great quantities mostly but not exclusively on isolated healthy pines of medium size (about 3 to 5 inches in diameter), under pieces of bark which are almost entirely loosened, have about .3 to 1.0 mm. thickness, and abutt with inner surface against sap-containing parts of the bark. These sap-containing parts usually have a quite light brown color easily recognizable from the rufous or rufous-brown color of the outer bark. . . . In the district of Loujja the damage done by *A. cinnamomus* is appreciable, consisting in the

²³ Faune Russe, Hemipt., vi, p. 89, (1913).

drying up of the treetops of pines which are overrun by quantities of these insects, which keep mostly under the loose pieces of bark on the upper part of the stem." (Translation from the Russian by Dr. A. Petrunkevitch.) The species exhibits but little variation in the eastern states, but in the west a form has developed which seems to deserve subspecific rank.

Aradus (Aradus) cinnamomeus subspecies **antennalis** subsp. nov.

Description.—Similar to the typical form except as follows: Antennae dark brown, the third segment bright yellow in apical half. Hemelytra in brachypterous female extending almost or quite to middle of third abdominal segment, and provided with a narrow but distinct membrane along the oblique apical margin of the corium.

Holotype.—♀; Kelowna, British Columbia, V, 20, 1917 (R. C. Treherne), in the National Collection at Ottawa.

Allotype.—♂; same data.

Paratypes.—Vernon, British Columbia, IV, 12, 1915 (M. H. Ruhmann); Easton, Washington (A. Koebele); Folsom, California, VII, 18, 1885; in my collection. Glen, Sioux County, Nebraska, VIII, 1903, in H. G. Barber's collection; Siskiyou County, California, VI, 1, 1911 (F. W. Numemacher), in W. J. Gerhard's collection.

This is a western form which cannot be separated specifically, but it is rather well distinguished by the characters given. Specimens taken in the eastern states lack the membrane, hardly a trace ever being noticeable, but European examples sometimes have it as well developed as in the western race. With the single exception of a specimen from northwestern Nebraska all material referable to *antennalis* which I have seen has been collected in the Pacific region. In California the typical form also occurs.

56. Aradus (Aradus) orbiculus Van Duzee (Plate VII, fig. 56.)

1920. *Aradus orbiculus* Van Duzee, Proc. California Acad. Sci., (4), ix, p. 337.

Distribution.—CALIFORNIA: Huntington Lake, Fresno County, 7000 feet, VII, 17, 1919 (E. P. Van Duzee); Placer County, X. IDAHO: Moscow Mountain, X, 29, 1910 (J. A. Hyslop).

Description.—Blackish brown; inner margins of genital lobes and sometimes posterior margins of connexival segments reddish; legs and rostrum reddish brown.

Head much longer than broad (48 to 36); tylus long, one-half length of head, compressed, sides nearly parallel; impressions of vertex broad, slightly divergent, indefinitely connected posteriorly; preocular tubercles distinct, conical; antenniferous spines moderately acute, divergent, the lateral tooth rudimentary; postocular tubercles obsolete; antennae (fig. 56e) moderately slender, almost cylindrical, nearly as long as head and pronotum together (75 to 78), the first segment not quite reaching middle of tylus, the second longer than distance between eyes (30 to 20); rostrum (σ) extending just beyond apex of mesosternum, (φ) to middle of mesosternum. Scutellum almost as long as head (45 to 48); sides elevated, disc almost entirely flat.

σ , stenopterous (fig. 56b). Pronotum much shorter than head (24-37), flattened posteriorly and in general reduced; carinae distinct. Hemelytra reaching apex of genital segment, strongly narrowed (somewhat less so than in fig. 60d.3), corium to fifth segment; exocorium strongly expanded at base; mesocorium with numerous transverse veins, endocorium without; cross-veins of membrane obsolescent. Hind wings apparently absent. Fifth ventral segment slightly shorter than sixth; genital segment rather short, moderately convex, the lobes long; abdomen oblong-oval, lateral margins almost entire. Length, 7.5 mm.; width, 3 mm.

φ , brachypterous (figs. 56a, 56d). Pronotum much shorter than head (30 to 48), similar to that of male. Hemelytra abbreviated (fig. 56d), slightly longer than scutellum, longitudinal veins distinct, membrane vestigial. Posterior margin of dorsal genital segment nearly straight; abdomen broadly oval, the lateral margins almost entire, breadth at fifth segment equal to length behind scutellum. Length, 10.7 mm.; width, 5.5 mm.

Type specimens (California), Nos. 684 and 685, California Academy of Sciences.

This extraordinary species is not closely related to any other, but exhibits some affinity with *cinnamomeus* and with *heide-manni* in type of wing polymorphism, so that it may be placed as a connecting link, in some respects, between the subgenera. It is likely that the macropterous female exists and will be discovered, probably having the pronotum convex posteriorly and sinuate laterally (as in fig. 60d).

57. *Aradus (Aradus) insolitus* Van Duzee (Plate VII, fig. 57.)

1916. *Aradus insolitus* Van Duzee, Univ. of Calif. Pubs., Tech. Bulls., Ent., 1, p. 233.

1917. *Aradus insolitus* Van Duzee, Cat. Hem., p. 135.

Distribution.—BRITISH COLUMBIA: Vernon, IV, 12, 1915 (M. H. Rubmann). CALIFORNIA: Fallen Leaf Lake and Glen Alpine, Eldorado County, VII, 12, 1915 (E. P. Van Duzee), VII, 22, 1915 (E. C. Van Dyke); Keen Camp, San Jacinto Mountains, VI, 8, 1917 (E. P. Van Duzee).

Description.—Black, the surface, including appendages, conspicuously marked with pale greenish granules; second antennal segment with a white apical ring of variable width; postero-lateral margins of pronotum narrowly pale; apex of scutellum broadly and indefinitely reddish yellow; apical angles of connexival segments and inner margins of genital lobes pale; femora and tibiae pale at apex; membrane whitish hyaline, with large brownish spots.

Head almost as long as broad (20 to 21), longer than pronotum (20 to 18); tylus of moderate size, slightly enlarged at middle; impressions of vertex short, deep, strongly divergent anteriorly; preocular tubercles obsolescent; antenniferous spines rather short, conical, divergent, the lateral tooth obsolescent; postocular tubercles slight; antennae (fig. 57c) moderately stout, somewhat shorter than head and pronotum together (34 to 38), the first segment reaching middle of tylus, second about as long as distance between eyes; rostrum short, extending slightly beyond apex of prosternum. Pronotum (fig. 57d) very slightly and irregularly convex, the lateral margins rather broadly expanded, not reflexed, finely and rather irregularly denticulate, straight or slightly concave posteriorly; carinae slightly elevated. Scutellum longer than pronotum (23 to 18), rather elongate, sides almost evenly arcuate from base, very slightly elevated; apex broadly rounded; discal elevation very slight. Hemelytra (σ) reaching genital lobes, corium to base of fourth segment, moderately narrowed, exposing most of connexivum at sides; (φ) reaching base or middle of dorsal genital segment, corium to base or nearly to apex of fourth, more strongly narrowed, exposing disc of abdomen at sides; basal expansion of exocorium moderate, evenly rounded, moderately reflexed; mesocorium and endocorium with several distinct transverse veins. Abdomen rather broadly oval, the lateral margins crenate.

σ (fig. 57b). Fifth ventral segment slightly shorter than sixth; genital segment rather short, strongly convex, the lobes long. Length, 4.5 mm.

φ (fig. 57a). Posterior margin of dorsal genital segment transverse at middle, sharply sinuate at sides near spiracles. Length, 4.8 to 5.2 mm.

Type specimens (Fallen Leaf Lake, California) in the Museum of the University of California.

This is a rare and very singular form, quite distinct in most of its characters, particularly in the shape of the pronotum. As Van Duzee remarks in connection with the original description: "The short rostrum allies it with *Quilnus* and in some respects it is intermediate between that subgenus and the more typical aradids."

Subgenus *Quilnus* Stål

1873. *Aradus* (*Quilnus*) Stål, Enum. Hem., 3, p. 137.

1913. *Aradus* subgenus *Quilnus* Kiritshenko, Faune de la Russie, Ins. Hém., vi, Livr. 1, p. 262.

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Rostrum short, not or scarcely reaching base of head; the pronotum more or less distinctly trapezoidal, comparatively small and narrow, the lateral margins scarcely explanate. This group contains a few representatives in both the Old and the New Worlds, which have in common the few distinctly subgeneric characteristics mentioned. The coloration is prevailingly dark and a majority of the species exhibit pterygo-polymorphism.

58. *Aradus (Quilnus) niger* Stål (Plate VII, fig. 58.)

1873. *Aradus niger* Stål, Enum. Hem., 3, p. 137.

1901. *Aradus niger* Heidemann, Proc. Ent. Soc. Washington, IV, p. 389.

Distribution.—NOVA SCOTIA: VI (Wm. T. Davis). MAINE: Eastport, X, 12 (H. S. Barber); Mount Katahdin, 3000 feet, VIII, 1902 (H. G. Barber); Orono, IV, 29, 1914, V, 27, 1913 (H. M. Parshley). NEW HAMPSHIRE: Crawfords, IX, 26, 1916 (H. M. Parshley). MASSACHUSETTS: Northampton, X, 8, 1919 (Priscilla Butler); Pelham, VIII, 28, 1919 (H. M. Parshley). NEW YORK: Hamburg, IX, 22, 1901 (E. P. Van Duzee); Ithaca, IV, 16, 1897; Lake George, VIII, 22, 1893 (J. L. Zabriskie). NEW JERSEY: Lakehurst, IV, 25 (Wm. T. Davis). DISTRICT OF COLUMBIA: Brightwood, X, 22 (O. Heidemann); Washington, IV, 12 (O. Heidemann). VIRGINIA: Falls Church, IX, 19 (N. Banks). NORTH CAROLINA: Southern Pines, I, 1904 (F. Sherman). SOUTH CAROLINA. COLORADO: Boulder (G. Weston). TEXAS: Kirbyville, XI, 17, 1902 (A. D. Hopkins). MEXICO.

Description.—Black; basal expansion of corium, apical angles of connexival segments, and sometimes their posterior margins, very obscurely pale.

Head as long as broad; tylus very short, extending but little beyond first antennal segment, laterally compressed; impressions of vertex broad, very shallow, oval; preocular and postocular tubercles obsolete; antenniferous spines short, stout, slightly divergent, without lateral tooth; antennae (fig. 58c) very thick, much shorter than head and pronotum together (36 to 43), the first segment very broad, extending nearly to apex of tylus, length of second much less than distance between eyes (11 to 17); rostrum barely reaching level of posterior margin of eyes. Margins of pronotum finely granulate. Abdomen oval, the lateral margins almost entire.

Macropterous form (fig. 58d.1). Pronotum shorter than head (18 to 25), moderately convex, the lateral margins nearly straight, a little reflexed at middle; carinae feebly developed. Scutellum much longer than head (30 to 25), the sides slightly and obtusely raised; disc slightly elevated before middle. Hemelytra (σ φ) almost evenly narrowed from basal expansions, exposing connexivum, extending to genital segment, corium about to apex of third segment; exocorium moderately expanded at base; mesocorium and endocorium with one or without distinct transverse veins; veins of membrane reticulate toward apex. Abdomen oval, less than one-half wider than pronotum (63 to 45).

Brachypterous form (fig. 58d.2). Pronotum much reduced, about half as long as head, flat; the carinae obsolescent. Scutellum shorter than head (23 to 25), the sides slightly and obtusely elevated, the disc concave. Hemicytra (σ^7 φ) a little longer than scutellum; corial veins obsolescent; membrane absent.

σ^7 (fig. 58b). Fifth ventral segment a little shorter than sixth; genital segment rather short, strongly convex. Length, 5 mm.

φ (fig. 58a). Posterior margin of dorsal genital segment sinuate, concavely curved at middle; genital lobes irregularly eroded, the tooth and sinus very variable in form. Length, 5.5 to 6.5 mm.

Type specimens (South Carolina) in the Stockholm Museum.

This widely distributed and locally common species is readily recognized by the structure of the antennae, the straight pronotal margins in the macropterous form, and the genital characters. Heidemann (1901) was the first to locate it, subsequently to the original discovery, and later (1904) had specimens from the National Museum collection compared with Stål's types.

59. *Aradus (Quilnus) nigrinus* sp. nov. (Plate VII, fig. 59.)

Description.—Dark grayish brown; antennae black; apical angles of connexival segments obscurely pale; ventral surface dark reddish brown.

Head slightly broader than long (26 to 25), longer than pronotum (25 to 20); tylus short, distinctly narrowed from base to apex; impressions of vertex broad, moderately deep, divergent, indistinctly connected posteriorly; preocular and postocular tubercles obsolete; antenniferous spines extremely short, acute, scarcely divergent, the lateral tooth obsolescent; antennae (fig. 59e) cylindrical, moderately stout, about as long as head and pronotum together, the first segment elongate, reaching anterior fourth of tylus, length of second somewhat less than distance between eyes (15 to 18); rostrum extending a little beyond level of posterior margin of eyes. Pronotum (fig. 59d) moderately convex, lateral margins slightly curved, a little expanded and reflexed, granulate; carinae indistinct, the median pair conjointly elevated and obsolescent in posterior fourth, intermediate pair scarcely developed, lateral pair distinct. Scutellum much longer than head (34 to 25), shaped as in *niger* (fig. 58d.1); sides distinctly elevated; discal elevation low, rounded. Hemicytra (φ) moderately narrowed, exposing most of connexivum at sides, not reaching dorsal genital segment, corium to middle of third segment; exocorium moderately and unevenly expanded at base; mesocorium with one, endocorium without distinct transverse veins; veins of membrane reticulate toward apex.

σ^7 . Unknown.

φ (fig. 59a). Posterior margin of dorsal genital segment slightly sinuate, almost straight at middle; abdomen rather broadly oval, one-half wider than pronotum (75 to 50). Length, 7.6 mm.

Holotype.—♀; Huachuca Mountains, Arizona, No. 202, Museum of the Brooklyn Institute of Arts and Sciences.

This species is related to *niger*, from which it is distinct in antennal and pronotal structure, larger size, and broader form. It is probable that brachypterous forms will be found, having a different pronotal shape but readily recognized by antennal characters.

60. *Aradus (Quilnus) heidemanni* Bergroth (Plate VII, fig. 60.)

1906. *Aradus Heidemanni* Bergroth, Can. Ent., xxxviii, p. 200.

Distribution.—BRITISH COLUMBIA: Bear Lake, London Hill Mine, VII, 21 (R. P. Currie); Kokanee Mountain, 9000 feet, VIII, 10, 1903 (R. P. Currie); Victoria, Vancouver Island (G. W. Taylor). WASHINGTON: Mount Rainier, Paradise Park, 6000 feet, VII, 15 to 31, 1905 (E. C. Van Dyke). OREGON: Astoria, V, 25, 1902; Dilley. CALIFORNIA: Carville, Trinity County, V, 7, 1913 (E. C. Van Dyke); Mount Hood, 6000 feet, VIII, 19, 1916 (G. P. Engelhardt); Mohave (Calif.?). NEW MEXICO: Clouderoft. COLORADO: Colorado Springs, VIII to IX (J. E. Jack).

Description.—Dull dark brown to grayish black; membrane sometimes pale.

Head about as long as broad; tylus short, compressed, narrowed toward apex; impressions of vertex rather deep, slightly divergent, connected posteriorly; preocular tubercles small, acute, antenniferous spines acutely conical, moderately divergent, the lateral tooth small or absent; postocular tubercles prominent, rounded; antennae (fig. 60c) moderately slender, cylindrical, about as long as head and pronotum (*f. macrop.*) together, the first segment reaching anterior third of tylus, length of second a little less than distance between eyes (18 to 20); rostrum not quite reaching base of head. Pronotal margins irregularly granulate. Abdomen broadly oval, the margins slightly notched.

Macropterous form, ♂ ♀ (fig. 60d.1). Pronotum moderately convex posteriorly, shorter than head (30 to 25), lateral margins moderately expanded and slightly reflexed, sinuate; carinae distinct. Scutellum longer than head, sides slightly curved, rather strongly elevated; disc flat to base, with a slight central elevation. Hemelytra moderately narrowed, exposing connexivum, (♂) extending to genital lobes, corium to base of fourth segment; (♀) to base or nearly to apex of dorsal genital segment, corium to base of fourth; exocorium moderately expanded at base; mesocorium with one or two, endocorium with one or without distinct transverse veins; veins of membrane somewhat branched toward apex.

Stenopterous form, ♂ (fig. 60d.3). Pronotum reduced, much shorter than head (20 to 30), flattened, depressed posteriorly, lateral margins straight, not expanded; carinae indistinct, except median pair in anterior two-thirds. Scutellum as long as head, the sides obtusely elevated; disc uniformly depressed. Hemelytra greatly narrowed, extending well over genital segment; membrane distinct; hind wings absent.

Brachypterous form, ♀ (fig. 60d.2). Similar to the preceding form except as follows: Hemelytra abbreviated, shorter than scutellum, the corial veins obsolete; membrane absent.

♂ (fig. 60b). Fifth ventral segment a little shorter than sixth; genital segment short, moderately convex, the lobes long. Length, 6.75 mm.

♀ (fig. 60a). Posterior margin of dorsal genital segment nearly straight; form of genital lobes somewhat variable. Length, 7.25 to 7.8 mm.

Type specimens (British Columbia and Oregon) in Bergroth's collection, and in the Heidemann collection, Cornell University paratype, No. 251.1.

This is a strikingly distinct species, readily distinguished by its size and antennal structure. It presents all the phases of wing polymorphism found in the genus, and is of especial interest on account of the male dimorphism.

LIST OF WORKS CITED

BARBER, H. G.

1914. Insects of Florida. II. Hemiptera. Bull. Am. Mus. Nat. Hist., xxxiii, pp. 495 to 535.

BERG, CARLOS

1879. Hemiptera Argentina enumeravit speciesque novas descripsit. Buenos Aires.

BERGROTH, E.

1886. Ueber einige amerikanische Aradiden. Wiener Ent. Zeit., v, pp. 97 to 98.

1887. Notes sur quelques Aradides nouveaux ou peu connus. Rev. Ent., vi, pp. 244 to 247.

1889. Notes sur quelques Aradides appartenant au Musée Royal d'Histoire Naturelle de Bruxelles. Compt. rend. Soc. Ent. Belg., 1889, pp. clxxx to clxxxii.

1892. Notes on the Nearctic Aradidae. Proc. Ent. Soc. Wash., ii, pp. 332 to 337.

1892. Additional note on Nearctic Aradidae. Proc. Ent. Soc. Wash., ii, pp. 337 to 338.

1895. Aradidae Novae.

Wiener Ent. Zeit., xiv, pp. 167 to 171.

1906. Notes on American Hemiptera. Can. Ent., xxxviii, pp. 198 to 202.

1913. Notes on American Hemiptera. II. Can. Ent., xlv, pp. 1 to 8.

CHAMPION, G. C.

1897-1901. Biologia Centrali-Americana. Insecta. Rhynchota. Hemiptera-Heteroptera. II. London.

FABRICIUS, J. C.

1803. Systema Rhyngotorum. Brunsvigae. Pp. i to x, 1 to 314.

TRANS. AM. ENT. SOC., XLVII.

FALLEN, C. F.

1807. Monographia Cimicium Sueciae. Hafniae. Pp. 1 to 123.

FYLES, THOMAS W.

1903. *Aratus luteolus*, n. sp. Can. Ent., xxxv, pp. 75 to 76.

GAY, CLAUDE

1844-1871. Historia física y política de Chile, etc. Paris.

HEIDEMANN, OTTO

1901. Note on *Aradus* (*Quilhus*) *niger* Stål. Proc. Ent. Soc. Wash., iv, pp. 389 to 390.

1904. Notes on North American Aradidae, with descriptions of two new species. Proc. Ent. Soc. Wash., vi, pp. 161 to 165.

1904. Notes on a few Aradidae occurring north of the Mexican boundary. Proc. Ent. Soc. Wash., vi, pp. 229 to 233.

1907. Three new species of North American Aradidae. Proc. Ent. Soc. Washington, viii, pp. 68 to 71.

1909. Two new species of North American Aradidae. Proc. Ent. Soc. Washington, xi, pp. 189 to 191.

1910. [Notes on Hemiptera.] Proc. Ent. Soc. Washington, xii, p. 47.

HUBBARD, HENRY G.

1892. The inhabitants of a fungus. Can. Ent., xxiv, pp. 250 to 255.

KIRBY, WILLIAM F.

1837. The insects. In Richardson's Fauna Boreali-Americana, iv. Norwich.

1878. Ibid. Reprinted by Bethune, C. J. S. Hemiptera. Can. Ent., x, pp. 137 to 139, 213 to 216.

KIRITSHENKO, A. N.

1913. Faune de la Russie et des pays limitrophes fondée principalement sur les collections du Musée Zoologique de l'Académie des Sciences de St. Pétersbourg. Insecta. Hemiptera. vi, liv. 1, 1 to 301 pp.

KIRKALDY, G. W.

1899. A guide to the study of British waterbugs (aquatic Rhynchotha). Polymorphism. Entom., xxxii, pp. 108 to 115.

LETHERRY, L., ET SEVERIN, G.

1896. Catalogue général des Hémiptères, iii.

OSBORN, H.

1903. Aradidae of Ohio. Ohio Nat., iv, pp. 36 to 42.

PANZER, G. W. F.

1793-1805. Fauna insectorum Germanicae initia oder Deutschlands Insecten. Nürnberg.

REUTER, O. M.

1875. Remarques sur le polymorphisme des Hémiptères. Ann. Soc. Ent. France, (5), v, pp. 225-236.

1884. Ad cognitionem Aradidarum palaearcticarum. Wiener Ent. Zeit., iii, pp. 129 to 138.

1900. De finska arterna af *Aradus lugubris*-gruppen. Medd. Soc. Fauna et Flora Fennica., xxvi, pp. 1 to 9.

- 1911-1912. Bemerkungen über mein neues Heteropterensystem. *Ovf Finska Vet.-Soc. Förh.*, LIV, (A), no. 6, pp. 1 to 62.
- SAY, THOMAS
1825. Descriptions of new Hemipterous insects collected in the expedition to the Rocky Mountains, performed by order of Mr. Calhoun, Secretary of War, under command of Major Long. *Journ. Acad. Nat. Sci. Philadelphia*, iv, pp. 307 to 345.
- 1831-1832. Descriptions of new species of Heteropterous Hemiptera of North America. New Harmony, Indiana.
1859. Complete Writings. Philadelphia, 2 vols.
- SCHARFF, R. F.
1912. Distribution and origin of life in America. New York. Pp. i to xvi, 1 to 497.
- SIGNORET, V.
1863. Révision des Hémiptères du Chili. *Ann. Soc. Ent. France*, (4), III, pp. 541 to 588.
- SLOSSON, ANNIE TRUMBULL
1895. Additional list of insects taken in alpine region of Mt. Washington. *Ent. News*, vi, pp. 316 to 321.
- SPOONER, C. S.
1920. A Note on the mouthparts of the Aradidae. *Ann. Ent. Soc. Amer.*, XIII, pp. 121 to 122.
- STAL, C.
- 1870-1876. *Enumeratio Hemipterorum*. Stockholm. From K. Svenska Vet.-Akad. Handl., ix to xiv.
- UHLER, P. R.
1871. Notices of some Heteroptera in the collection of Dr. T. W. Harris. *Proc. Boston Soc. Nat. Hist.*, xiv, pp. 93 to 109.
1876. List of Hemiptera of the region west of the Mississippi River, including those collected during the Hayden explorations of 1873. *Bull. U. S. Geol. and Geog. Surv. Terr.*, i, pp. 269 to 361.
1878. Notices of the Hemiptera Heteroptera in the collection of the late T. W. Harris, M.D. *Proc. Boston Soc. Nat. Hist.*, xix, pp. 365 to 446.
1893. Summary of the collection of Hemiptera secured by Mr. E. A. Schwarz in Utah. *Proc. Ent. Soc. Wash.*, II, pp. 366 to 397.
- VAN DUZEE, EDWARD P.
1916. Notes on some Hemiptera taken near Lake Tahoe, California. *Univ. of Calif. Pubs., Tech. Bulls., Ent.*, i, pp. 229 to 249.
1917. Catalogue of the Hemiptera of America north of Mexico excepting the Aphididae, Coccidae and Aleurodidae. *Univ. of Calif. Pubs., Tech. Bulls., Ent.*, II, pp. i to xiv, 1 to 902.
1917. Report upon a collection of Hemiptera made by Walter M. Giffard in 1916 and 1917, chiefly in California. *Proc. California Acad. Sci.*, (4), VII, pp. 249 to 318.
1920. New Hemipterous insects of the genera *Aradus*, *Phytocoris* and *Camptobrochys*. *Proc. California Acad. Sci.*, (4), IX, pp. 331 to 356.
- TRANS. AM. ENT. SOC., XLVII.

WALKER, FRANCIS

1867-1873. Catalogue of the specimens of Hemiptera-Heteroptera in the collection of the British Museum. i to viii. London.

EXPLANATION OF PLATES

The figures have been drawn with the camera lucida, using the binocular microscope, with several degrees of magnification, but in all cases the antenna and pronotum are drawn to scale. In comparing the figures with specimens, it should be borne in mind that some slight discrepancies are to be expected, owing to variation in detail. The figures of genitalia are so arranged on the plates as to facilitate comparison with specimens placed in the most favorable positions for observation under the usual lighting conditions.

The following letters are used uniformly in connection with the figures of the various species:

- a. Ventral view of the posterior abdominal structures in the female.
- b. The same in the male, usually the terminal portion only.
- c. Antenna.
- d. Pronotum, sometimes with more or less of the neighboring parts.
- e. Dorsal view of the posterior abdominal structures in the female.

The following abbreviations are employed:

- ap. m. Apical margin.
- brach. Brachypterous form.
- d. g. s. Dorsal genital segment.
- en. Endocorium.
- ex. Exocorium.
- g. l. Genital lobe.
- m. Mesocorium.
- macr. Macropterous form.
- x-y. Imaginary line showing level of apical angles of sixth abdominal segment.
- 1g. First genital segment.
- 2g. Second genital segment.
- V. Fifth abdominal segment.
- VI. Sixth abdominal segment.